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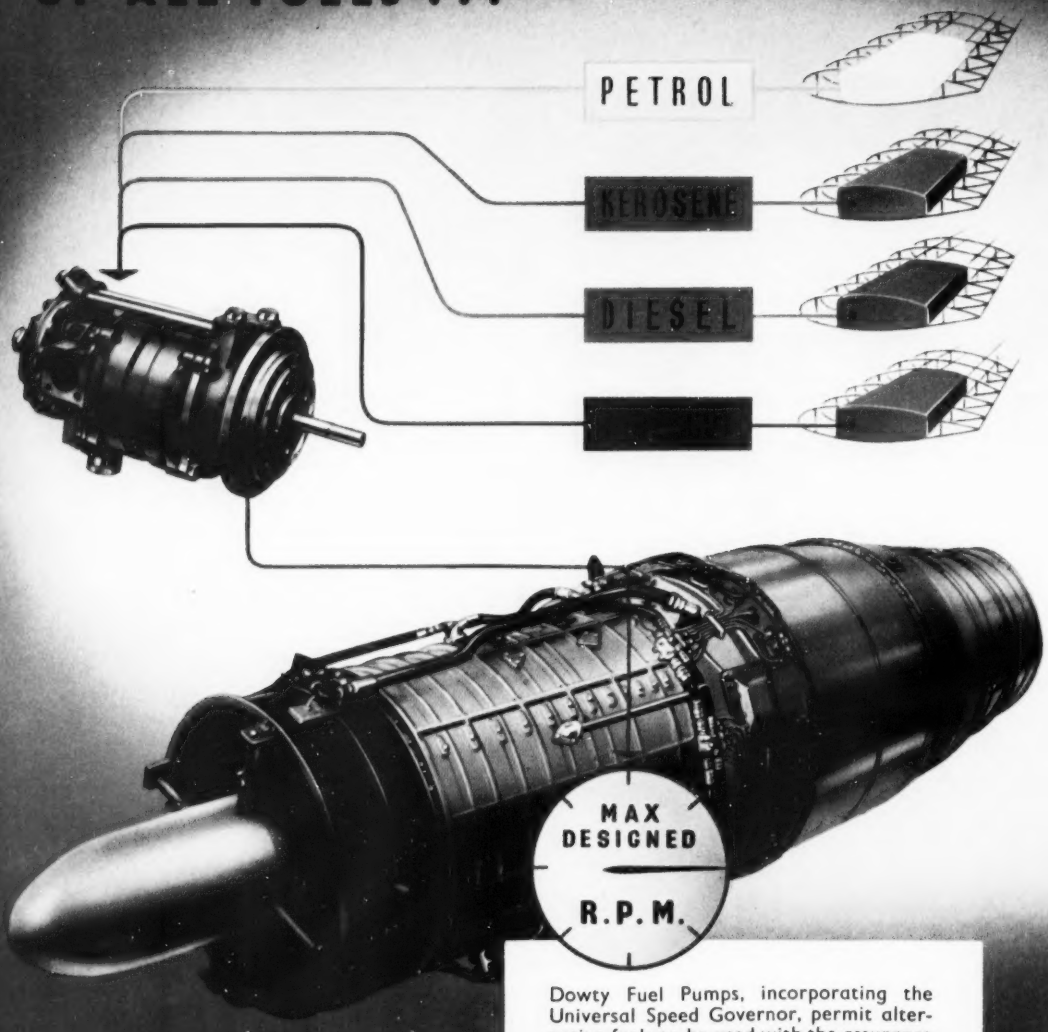

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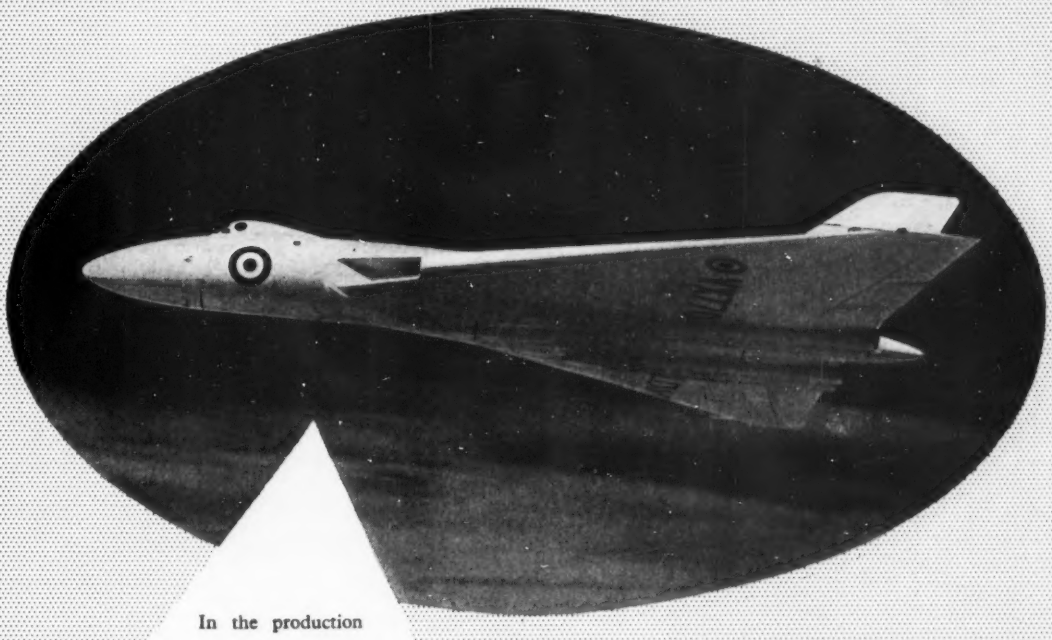

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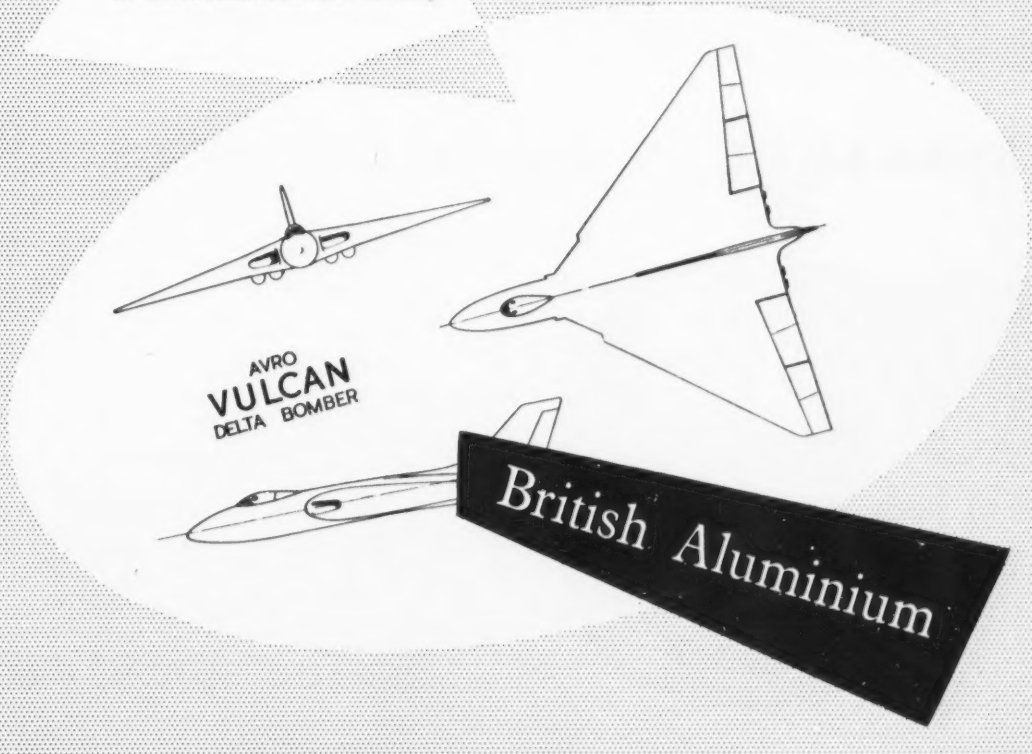

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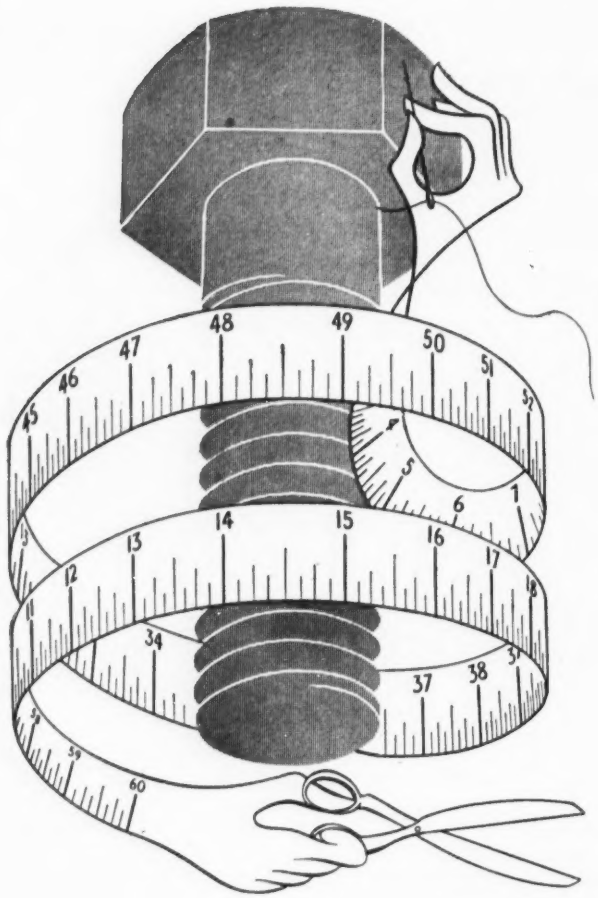

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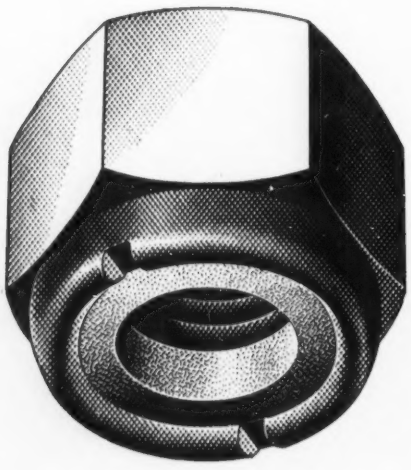

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Page Two

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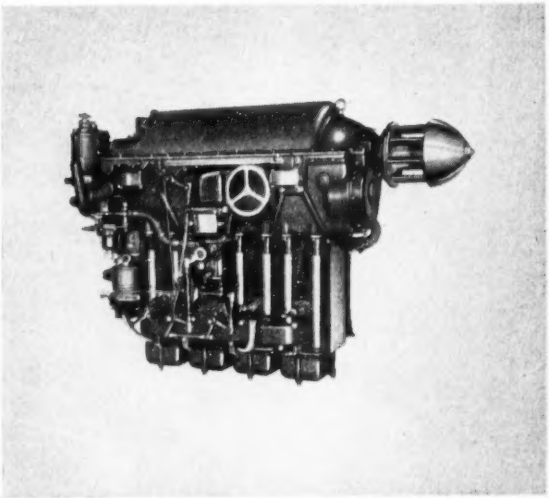

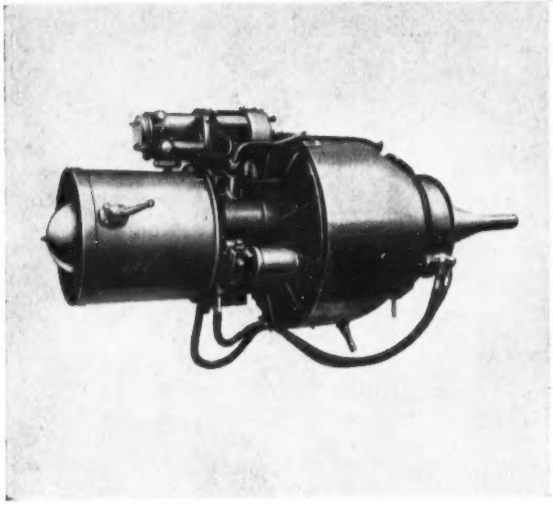

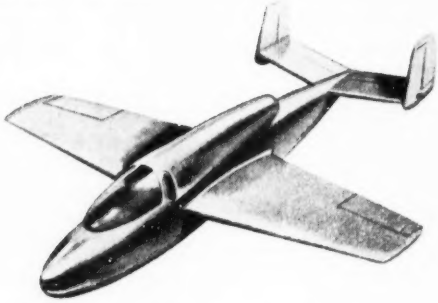

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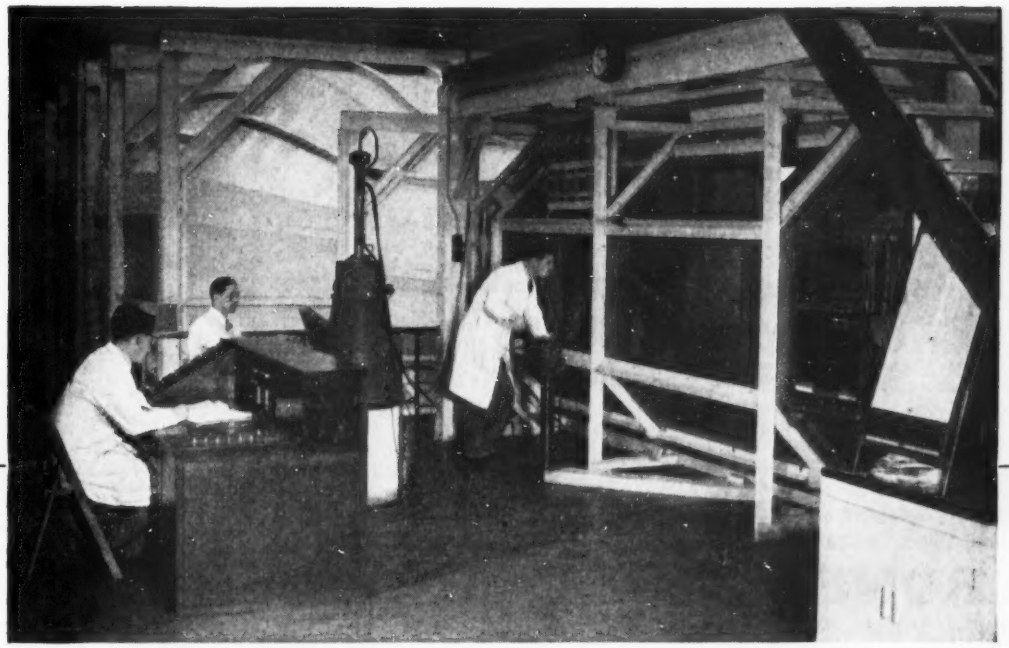

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P5.1

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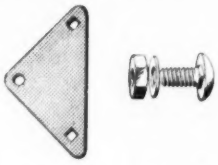

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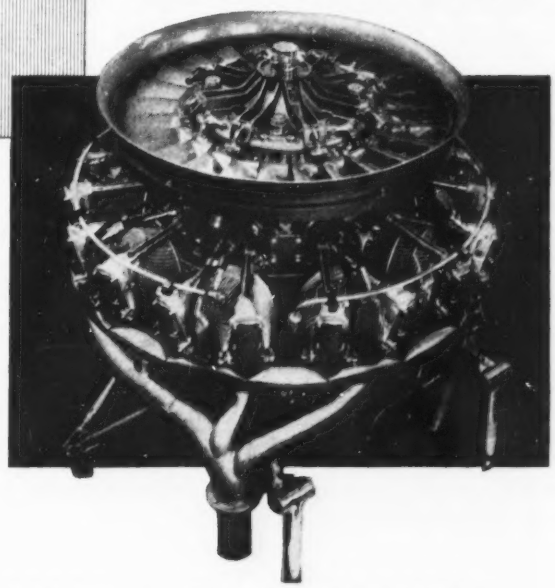

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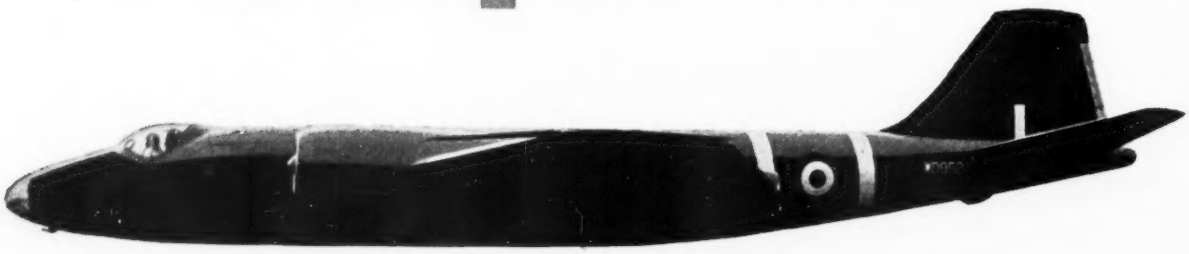

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'ENGLISH ELECTRIC' *Canberra* ...

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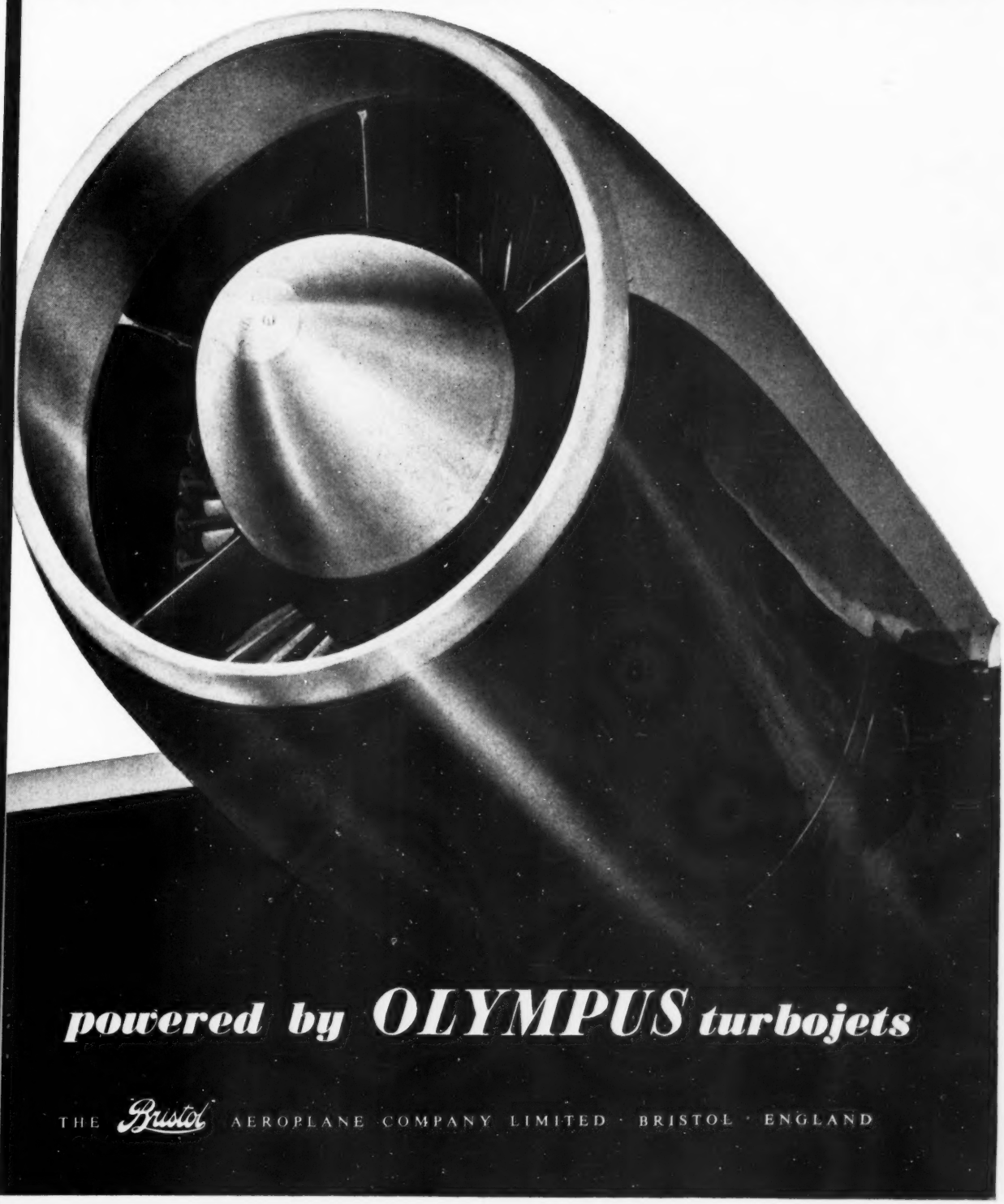
altitude record!



powered by OLYMPUS turbojets

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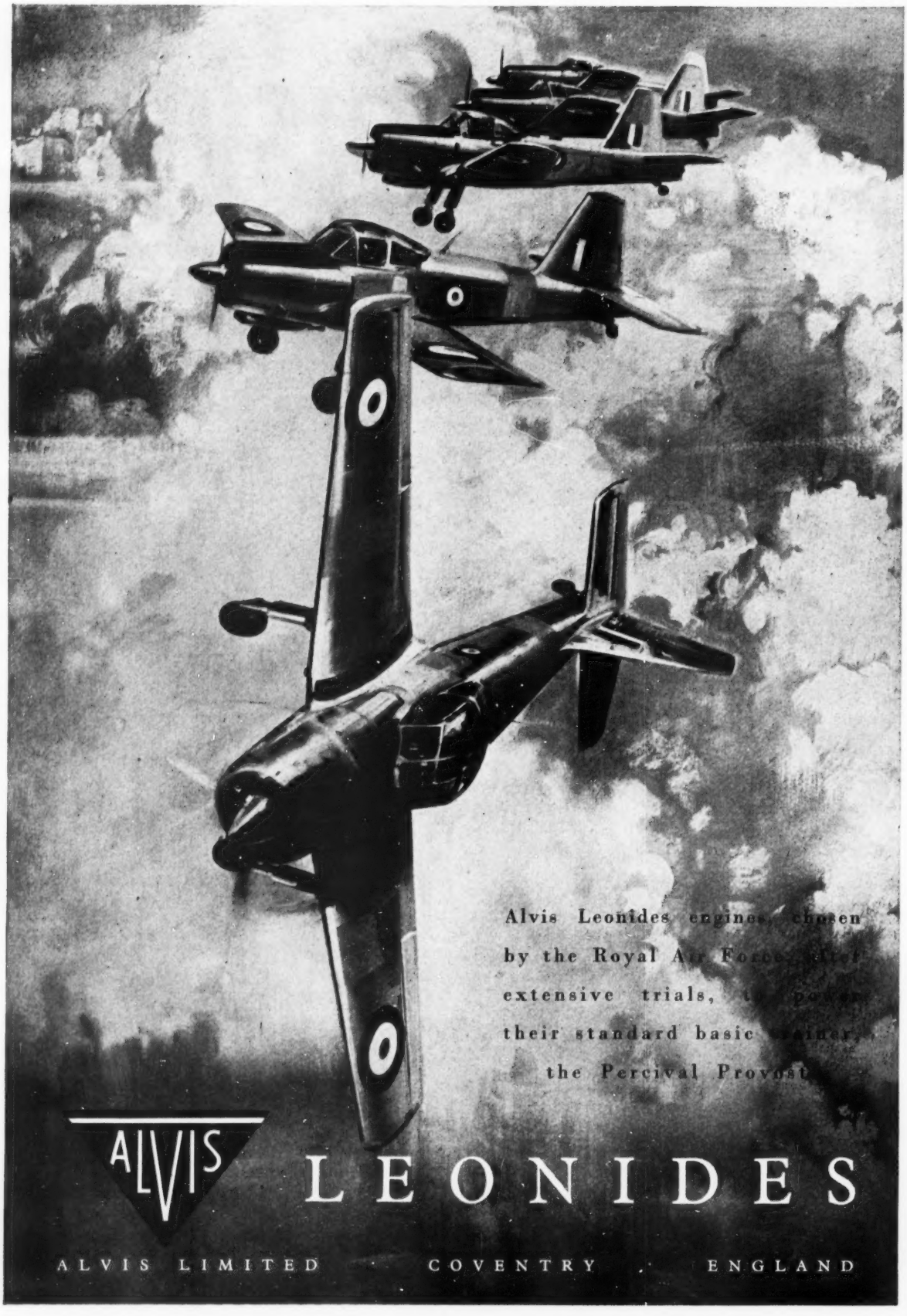
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Founded 1909

No. 2312 Vol. LXIII. FRIDAY, 15 MAY 1953

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ART EDITOR
JOHN YOXALL

Editorial, Advertising and Publishing Offices:

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STAMFORD STREET,
LONDON, S.E.1.

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Gnat for Nato

IT is our impression that those students of design who know most about the light-fighter concept and about the Folland Gnat are the most enthusiastic over its potentialities. The reactions of members of our staff who over a period have learned progressively more about Mr. Petter's design confirm this belief; and the increasing "buzz" to which the Gnat has given rise in this country, Europe and America seems to be in fair proportion to the growing appreciation of its particular advantages.

In a recent article (*Flight*, April 3rd) we first explained what the Gnat was not; then we pointed out that the true light fighter is a distinct and separate type bearing little relationship to a lightened conventional fighter or to a missile-like target-defence intercepter. In a sense the light fighter represents a state of mind. It is essential to withstand the conventional sort of enthusiasm which would lead one to suggest improvements and which would inevitably entail additional weight and elaboration.

How does the Gnat (or any comparable design) stand today? It has no official security grading, which might be taken to indicate that there is no official interest in this private venture. But a prototype is being built and is expected to fly in the first place with the power of an Armstrong Siddeley Viper. A promising Bristol axial turbojet at one time foreseen for the Gnat is no longer covered by a M.o.S. requirement; but, like the official attitude to the light fighter itself, these circumstances could change. The power requirement, ideally, is for a British axial unit giving some 4,000 lb thrust for a weight of 800 lb —figures by no means beyond attainment.

There are indications that Americans, usually quick to appreciate any new device, are interested in light fighters and in the Gnat itself, which is believed to differ radically from their own designs (by North American and others).

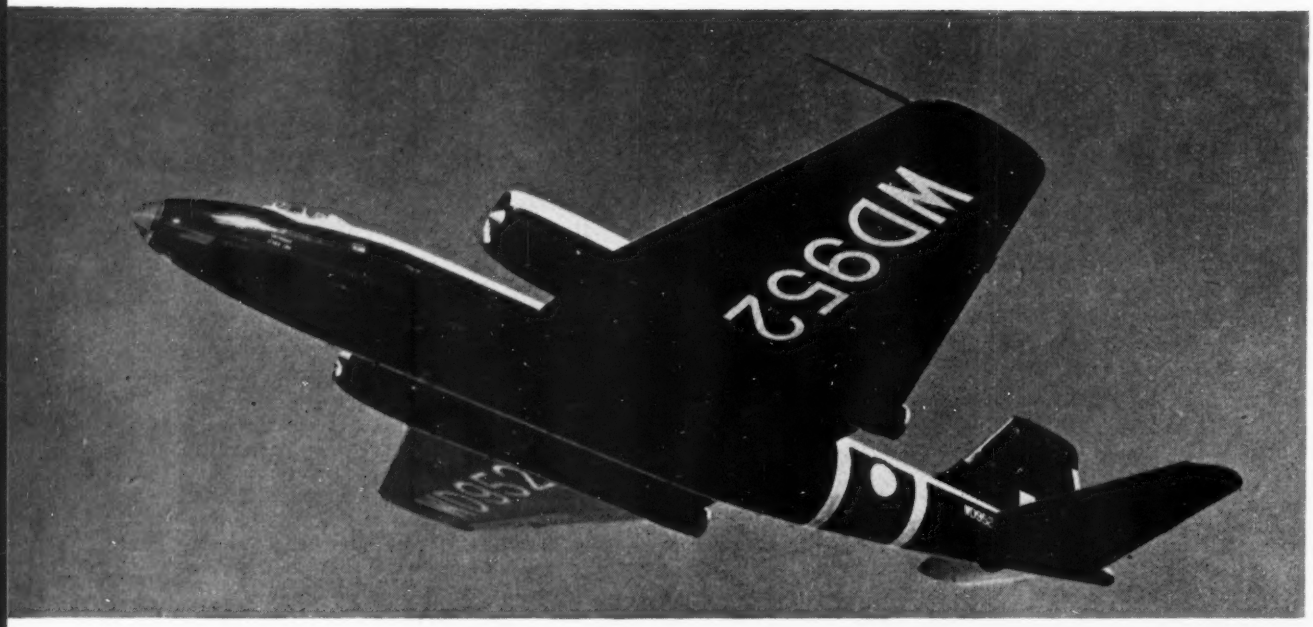
If it is accepted that a light, economical fighter can do a worthwhile military job, then it is not difficult to appreciate how attractive a proposition it could be to several of the NATO countries. The cost, a fraction of that of the Sabre, for example, would be less embarrassing to them and more acceptable to America from the point of view of off-shore purchases; additionally, considerably more aircraft could be provided for the same cost. Aircraft companies of quite modest size and experience, of which there are a number on the Continent, could all contribute towards production. The problems of servicing and operation would be greatly simplified, yet for its specialized fighter duties the machine itself would have a performance in advance of anything at present in service.

There are those, incidentally, who see a possible parallel between British success with the design and export of light cars and the chance of producing British light fighters for NATO. It would be regrettable if the light fighter concept were to be dismissed because of the many other costly military commitments and for want of careful consideration. In fact, it might help to alleviate those very financial problems which are now influencing the decision as to its development.

Forcible Feeding

THAT flying hours alone do not provide a yardstick to piloting ability or experience is well known to most flying folk, and to flying instructors in particular. We have found, however, that few people, including instructors, appreciate the fact that cramming of instructional flying hours can be a dangerous practice—dangerous because the result may mislead as to actual ability. To take a theoretical example, if two men of identical ability took an identical course of flying instruction entailing, say, 200 hours spread over in one case nine months and in the other eighteen months, the one who had the longer period to absorb his instruction and experience would, we contend, turn out to be the safer pilot. Both might well give the right answers to questions on procedures and emergencies, but the eighteen-month man would be more likely to react quickly and correctly in the air.

These brief and simple remarks are admittedly too much of an over-generalization to be applied directly to actual individuals or training, but the underlying contention is worth careful consideration; and, moreover, there is much evidence to support it.



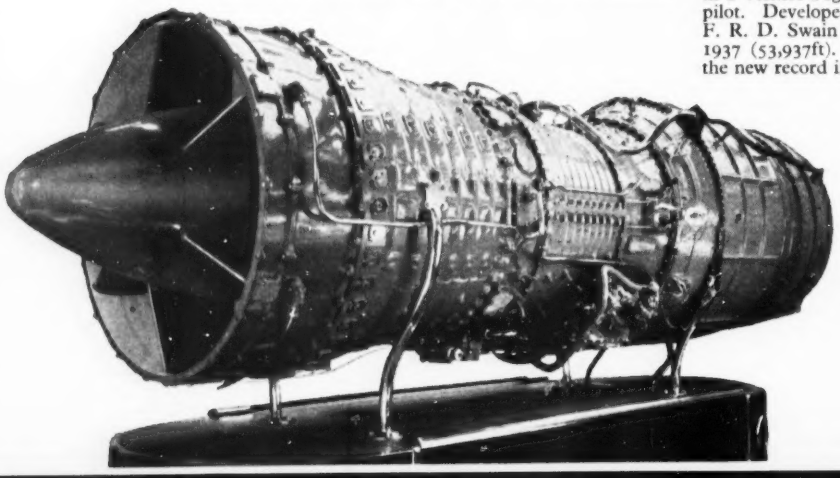
Olympus-Canberra at 63,668ft

Walter Gibb Beats John Cunningham's World Record by 7.1 per cent

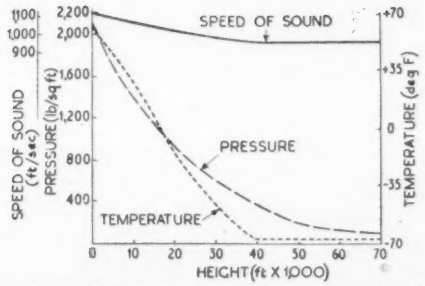
AT 1432 hr on May 4th the English Electric Canberra, WD952, powered by Bristol Olympus two-spool turbojets and owned by the Ministry of Supply, took off from Filton and climbed on a north-westerly course to 50,000ft. At this height, off the coast of Ireland, the pilot, W/C. W. F. Gibb, assistant chief test pilot to the Bristol Aeroplane Co., Ltd., levelled off for a short while in order to burn fuel. He then turned on to a south-easterly reciprocal course and resumed his climb. By 1517 hr, when the Canberra was over Taunton, Gibb was at the world-record height of 63,668ft. The Canberra landed at Filton at 1533 hr, having been in the air for 1 hr 1 min.

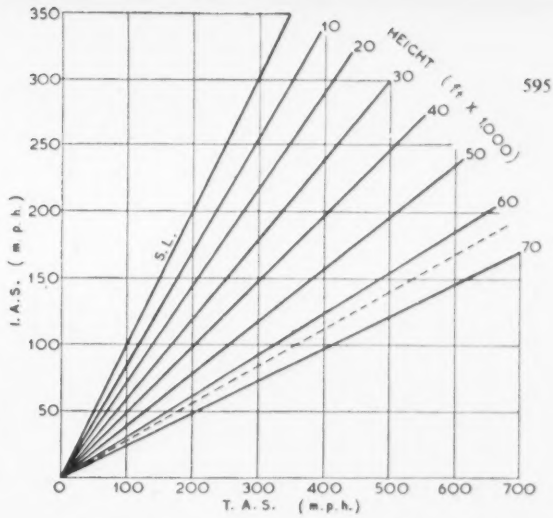
The flight was made under the surveillance of officials of the Royal Aero Club, the Fédération Aéronautique Internationale (to which body the new figure has been submitted for confirmation), the National Physical Laboratory, and the Royal Aircraft Establishment. Thus it was the responsibility of Major R. H. Mayo, F. A. Dismore, Philip Mayne, F. D. Jones, and Keith Smith to ensure that the new record was precisely determined and that it exceeded the previous best by 4 per cent. The former record of 59,446ft, established by John Cunningham in a long-span Ghost-Vampire, was, in fact, bettered by 7.1 per cent.

As in any attempt of this nature, the credit must be shared between several companies and individuals, but it is a matter of particular gratification to the Bristol company that, of five altitude records established since 1932 by Great Britain, four have been made with their engines. The present managing director of the company's aircraft division, Mr. C. F. Uwins, achieved 43,976ft in a Vickers Pegasus-Vespa during 1932. He was then chief test pilot. Developed versions of the Pegasus were used by S/L. F. R. D. Swain in 1936 (49,976ft) and by F/L. M. J. Adam in 1937 (53,937ft). The company point out that, important as is the new record in its own right, even greater significance attaches



Seen in the unusually fine study at the head of the page is Canberra WD952, Britain's latest record-breaker. Below it, in his Martin-Baker ejector seat, is W/C. W. F. Gibb, D.S.O., D.F.C., assistant chief test pilot of the Bristol Aeroplane Co., Ltd., who is the new record-holder. Third member of an illustrious trio is the Bristol Olympus two-spool turbojet, seen "enshrined" on the left.





These two diagrams show well the manner in which the chief properties of the atmosphere vary with height. At Olympus-Canberra height, for example, pressure is down to barely one-twentieth of that at sea-level; and a true air-speed of 400 m.p.h. would give about 95 knots on the clock ! Actual pressure and temperature was probably about 0.8 lb/sq. in. and —67 deg F.

to the demonstration of the ability of the Olympus to operate efficiently at immense heights. Inadequacy of air supply leads to compressor surge, flow breakdown, extinction of combustion and engine stoppage. It is their claim that the great increase in the "suffocation altitude" demonstrated by the record is due in large part to the two-spool design of the Olympus. (This, and other salient features of the Olympus, were dealt with in *Flight* of July 4th, 1952.)

The record figure was the end-product of multiple equations, each based on instrument readings recorded throughout the climb. The Canberra carried a sealed box containing two sensitive altimeters; two ratiometer-type temperature-indicators; a voltmeter; an A.S.I.; a temperature-indicator registering the temperature of the box exterior; and two cameras with their lighting, heating and control equipment. In order that the accuracy of the instruments should not vary with temperature change, the internal temperature had to be controlled within fine limits. All the instruments were calibrated by the N.P.L.—the temperature-indicators for their time-lag in response to temperature change and for their variation with electrical supply (hence the voltmeter); the altimeters and A.S.I. for instrument errors and position errors. The calibration of each was plotted against speed or height, or both, so that from the film of the readings the corrections could be applied and the final figures could be determined.

"Wally" Gibb—or W/C. Walter Frame Gibb, D.S.O., D.F.C., A.R.Ae.S.—was born in South Wales in 1919 and joined the engine division of the Bristol Aeroplane Co., Ltd., as an apprentice in 1937. Three years later he joined the R.A.F. and was commissioned in November, 1940. He rose to the rank of wing commander and became C.O. of No. 239 Squadron. He claimed six enemy aircraft destroyed (two of them in one night) while flying Beaufighters and Mosquitoes, and he first flew jet aircraft (Meteors) in 1945. On demobilization he returned to the Bristol Aeroplane Co. as a test pilot, flying Brigands and Type 170s. He has covered some 50,000 miles as the pilot of Freighters on demonstration tours of Spain, the Middle East, Africa and Scandinavia.

In 1949 W/C. Gibb was appointed co-pilot to "Bill" Pegg for the maiden flight of the Brabazon I. He is captain of the reserve flight-test crew of the Britannia and has flown the prototype on many of its test flights. He was appointed assistant chief test pilot at the beginning of this year.

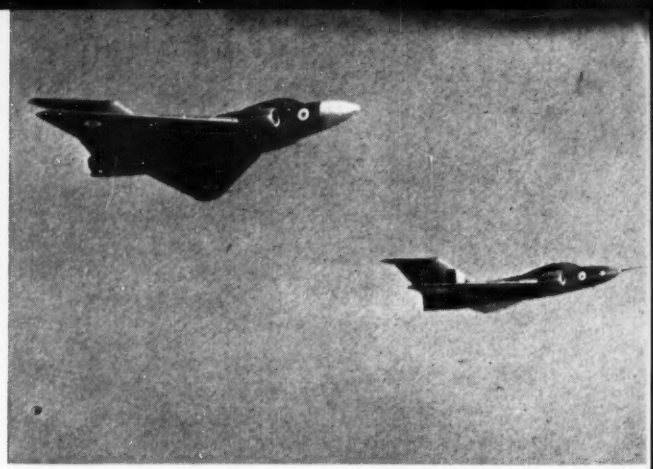
When arrangements were made with Canadair, Ltd., for the Bristol company to undertake repair and servicing of Sabres, W/C. Gibb completed a Sabre conversion course and has since handled the flight testing of Sabres at Filton. In August last year he flew the Olympus-Canberra on its maiden flight and has been responsible for most of the development flying. Although he was alone on the record flight, he was accompanied on all the preliminary high-altitude flights for Olympus development by Mr. F. M. Piper as flight observer. Thus to Mr. Piper goes the "record" of being the only man in the world to have flown as passenger at over 60,000ft.

It is understood that during development flying W/C. Gibb has deliberately cut both the Canberra's Olympus at very great heights and descended "dead stick" more than half the distance back to the earth.

On May 8th he flew the Canberra to London Airport, where she remained on show for two days. In the halcyon weather she attracted thousands of visitors. On landing W/C. Gibb said his record flight was his third to over 60,000ft; his high-altitude clothing was secret, and he remarked that the final 500ft—on instruments—entailed the most difficult flying in his experience. The cockpit was uncomfortably hot, but he had no feeling of lassitude.

The happy scene below was witnessed at Filton just after the record-breaking flight. W/C. Gibb is seen with Mr. C. F. Abell, service manager, engine division. Others in the group are:

Mr. George Wright (general manager, engine division), Mr. W. R. Verdon Smith (joint managing director), Mr. Brian Davidson (commercial director), Sir Alec Coryton (divisional managing director, engine division), Mr. R. Payne (production manager, engine division), Mr. J. Innes (executive assistant to Sir Alec Coryton), and Mr. George White (joint managing director). On the right, W/C. Gibb chats with Dr. S. G. Hooker, chief engineer of the engine division and director of the company. In the background is Mr. C. F. Uwins, managing director of the aircraft division, who himself set up a world altitude record in 1932 in the Pegasus-Vespa.



DESTROYER: Peeling off—under the practised direction of Gloster's Bill Waterton—is WT827, the third prototype Javelin F(A.W.)1, powered, like its predecessors with two Armstrong Siddeley Sapphires. As will be seen (especially in the second view, wherein the machine is formating with the second prototype, WD808) a "radar" nose is now installed.

FROM ALL QUARTERS

Canberras as Coronation Couriers

A REMARKABLE high-speed airlift is being laid on to transport television film recordings of the Coronation to Montreal so that Canadian viewers can see the ceremony on their screens during the afternoon and evening of Coronation Day itself. A helicopter will be used to take the films, in three batches, from Alexandra Palace to North Weald. Here R.A.F. Canberras will be ready to start for Goose Bay, 2,480 miles distant, at 1.30, 3 and 6 p.m. B.S.T. On reaching Goose Bay, the first batch of film will be taken to Montreal, some 800 miles farther on, by a CF-100 of the R.C.A.F., and the second and third batches will be conveyed subsequently by the first and second Canberras, which will meanwhile have been refuelled. In this way, and aided by the difference in longitude between Great Britain and Canada, it is expected that the recordings will reach Montreal at 4, 5.30 and 8.30 p.m., Canadian time.

The scheme was initiated by the Canadian Broadcasting Company, who will be responsible for the cost. Arrangements have been made for five American broadcasting companies and one television news agency to share in transmission of the films, which will comprise full-length recordings of the events seen on British screens, plus an edited version of the procession to the Abbey and the Coronation ceremony itself.

An additional arrangement has been made by the American Columbia Broadcasting System which, as well as showing the films relayed from Montreal, has chartered a B.O.A.C. Stratocruiser to fly other recordings direct to New York. The aircraft will be fitted up as a mobile editing room, and a team of operators will cut and arrange the available film *en route*, so that a fully edited one-hour programme will be available the moment a landing is made. This "potted" version of the ceremonies will be on the air appreciably later than the transmission from Canada.

D.H. Seek Big Capital Increase

A PROPOSAL to double the share capital of the de Havilland Aircraft Co., Ltd.—from £6m to £12m—will be considered at an extraordinary general meeting to be held immediately after the annual general meeting on May 29th. In the chairman's address, issued in advance of these meetings, Mr. F. T. Hearle states that "it is principally the considerations involved in producing the various marks of Comet airliners to meet the world-wide demand which has encouraged . . . this step." Enlarging on this, the chairman goes on to explain that much of the company's output in the past has been achieved by subcontracting and that it is expected to continue in this manner so far as military, naval and smaller civil types are concerned; but it is not possible, he points out, to use these facilities to the same extent for the construction of machines of the Comet's size and complexity, and a substantial increase in the company's overall capacity is essential. Adding that much has already been done in this direction, he pays tribute to the production assistance given by Short and Harland, Ltd.

The accounts, issued with the report, show that the net trading-year (to September 30th) revenue of the group was £2,332,320, increased by other income to £2,659,115 (1951, £2,487,780); net surplus, after taxation, was £597,108 (1951, £639,920). Commenting on the balance-sheet, the chairman remarks in his address that, while showing a considerable increase in trading, the final results do not differ greatly from those of the previous year. He goes on to explain that very heavy completion costs had to be met in respect of the B.E.A. Ambassador fleet; though Airspeed, Ltd., then a subsidiary company, had made certain provisions against excess costs, the fixed prices negotiated in 1948 proved inadequate in view of the steep rise in all costs during the period of manufacture. Also, early costs of any new type are high, and the Comet business included in the accounts is in that category; the benefit has yet to be felt.

Commenting on a topical matter, also, Mr. Hearle speaks of the suggestion that the opportunity now open to leading British aircraft manufacturers to capture a substantial part of the world airline market is beyond their strength and that the only solution lies along the lines of a partnership with the Government. "Personally," says Mr. Hearle, "I do not believe this to be the case. Heavy taxation and inflation have indeed weakened British industry generally, and the aircraft industry is no exception, but this surely does not mean that private enterprise is no longer able and willing to exploit the opportunities it has created. We certainly require the blessing and support of the Government and I think that . . . the granting of superpriority to leading civil aircraft types means that this need is realized."

Army A.O.P. Helicopters

ACCORDING to the military correspondent of the *Sunday Express*, the Army is to acquire about 100 helicopters for use on A.O.P. and liaison duties. Each Army H.Q., the correspondent understands, will have one observation and three liaison flights, each of four rotorplanes; Corps H.Q.s will have one observation and two liaison flights; and each armoured division will have its own observation flight.

"No comment" was the too-familiar reaction of the War Office when asked by *Flight* for confirmation of this story.

Dr. Hislop Joins Faireys

FROM the Fairey Aviation Co., Ltd., comes the announcement that they have appointed, as chief designer to their helicopter division, Dr. G. S. Hislop, Ph.D., B.Sc., A.R.T.C., M.I.Mech.E., A.F.R.Ae.S. The appointment comes at a time when the company has important work in hand on the Gyrodyne and Rotodyne—the two types developed by Capt. A. G. Forsyth, B.Sc., F.R.Ae.S., who, as chief helicopter engineer, remains responsible for mechanical design. This side of the company's business is, in turn, under the control of Prof. R. L. Lickley, B.Sc., D.I.C., M.I.Mech.E., F.R.Ae.S., the chief engineer.

Dr. G. S. Hislop.

Dr. Hislop, whose distinguished career in aeronautical research began in the early 1930s, and included posts at the A. and A.E.E. and R.A.E., joined British European Airways in 1947 as senior assistant to the Corporation's controller of research and special developments, Mr. N. E. Rowe, subsequently succeeding him and becoming responsible for helicopter development. In addition, he has been concerned with a number of other B.E.A. activities, among them the Elizabethan "sealed servicing" project; he was also in charge of the Gust Research Unit, the work of which formed the subject of a lecture which gained him the Simms Gold Medal.

POINTER TO PROGRESS: Shown in its "50-degree" configuration is the Short S.B.5 research aircraft (Rolls-Royce Derwent) flown by Mr. Tom Brooke-Smith. Wing-sweep will be increased until a maximum of 69 degrees is attained. A general-arrangement drawing appeared in our issue of February 20th.

The Navy's Avengers

IN the House of Commons on May 6th, the First Lord of the Admiralty, Mr. J. P. L. Thomas answered questions about the re-introduction of Avengers into Naval Aviation. Cdr. J. A. Langford-Holt, R.N. (Con., Shrewsbury) wanted to know when these American aircraft were first used in the Fleet Air Arm; and when their use was discontinued after the war. Mr. Thomas replied that Avengers came into operational use in the Royal Navy in February 1943, and were withdrawn from general use in April 1946.

Cdr. Langford-Holt then drew attention to the fact that five years ago the re-introduction of this aircraft was never contemplated by the Admiralty. Was the First Lord not satisfied that its re-introduction was a severe condemnation of the procedure by which the Admiralty acquired its aircraft?

Mr. Thomas disagreed with that proposition. The Avenger, he said, was used as a torpedo-bomber in 1947, but had been modified for anti-submarine work. It was discarded in 1947 because there was a great drain on dollars in buying spare parts; but a supply of these aircraft had now been received from America under M.S.A. to help until the Gannet came along.

Cdr. Langford-Holt asked if he would take a strong line in order to see that the Fleet Air Arm got the type of aircraft which undoubtedly it deserved. Mr. Thomas assured his questioner that he was taking "the strongest possible line."

National Air Race Entries

LAST week-end the Royal Aero Club announced entries—totalling 36—for the National Air Races, to be held at Southend-on-Sea Airport on Saturday, June 20th. This year, as already announced in our pages, there will be three international events; they are for the Grosvenor Challenge Cup (aircraft of a handicap speed up to 130 m.p.h.), Norton Griffith Challenge Trophy (130-150 m.p.h.) and the Kemsley Challenge Trophy (over 150 m.p.h.). These three events will also constitute heats for the King's Cup Race, which is confined to British aircraft and pilots, the first four of which in each of the three international contests will be elegible to compete. Actually, the whole entry is virtually British, the only foreign competitor being Capt. J. H. Christie from Norway, who this year will fly a Leopard Moth. Names of pilots (and, where they differ, of entrants) are :—

Grosvenor Challenge Cup.—Dr. W. L. James (Chilton D.W.1, Carden Ford); C. Gregory (Taylorcraft Plus D, Cirrus Minor 1); B. G. K. Maile (Taylorcraft Plus D, Cirrus Minor 1); D. R. Robertson (Moth Minor, Gipsy Minor); Capt. D. M. Spencer-Smith (Tiger Moth, Ginsy Maior 1); D. F. Ogilvy—entrant, S/L. P. E. Hindmarsh (Moth Maior, Ginsy Maior 1); J. R. Batt—entrant, F. A. Laker (Autocar, Gipsy Maior 1); G. A. Farley—entrant, C. R. Purley (Autocar, Gipsy Major 1); S/L. N. F. Duke—entrant, A. N. Spriggs (Hawker Tomtit, Mongoose 3C); E. W. Westbrook (Messenger 4a, Gipsy Major 1D); N. M. Browning (Messenger 4a, Gipsy Major 1D); Capt. J. H. Christie (Leonard Moth, Ginsy Major 1).

Norton-Griffiths Trophy.—K. M. Freeman (Hawk Trainer 3, Gipsy Major 1); W. P. Bowles (Messenger 2a, Cirrus Major 3); C. W. W. Turner—entrant, C. H. Bennion (Messenger 2a, Cirrus Maior 3); D. C. Jemmett (Hawk Trainer 3, Ginsy Maior 1C); G. F. Bullen—entrant, Sir Frank Spriggs (Miles Whitney Straight, Gipsy Major 1); Miss F. M. Leaf (Hawk Major, Gipsy Major 1); A. J. Spiller (Leonard Moth, Gipsy Major 10-2); W. P. I. Fillingham—entrant, W/C. C. A. Pike (Chipmunk 1, Ginsy Major 10C); F/O. M. R. T. Chandler—entrant, S/L. J. A. R. King (Hawk Trainer 3, Gipsy Major 1); D. J. Bennett (Proctor 5, Gipsy Queen 2); G. R. I. Parker—entrant, R. Blackburn (Proctor 5, Gipsy Queen 2); H.R.H. Prince Alexander of Jugoslavia (Proctor 5, Gipsy Queen 2).

Kemsley Trophy.—G. Marler (Falcon Six, Gipsy Six 1); H. J. G. Turner (Proctor 3, Gipsy Queen 2); P. G. Lawrence (Proctor 1, Gipsy Queen 2); W/C. R. H. McIntosh (Proctor 1, Gipsy Queen 2); A. S. K. Paine (Proctor 1, Gipsy Queen 2); J. P. Crowther (Proctor 3, Gipsy Queen 2); F. Murphy—entrant, T. O. M. Sopwith (Hawker Hart, Kestrel 16); G/C. C. M. M. Grece (Nighthawk, Gipsy Six 2); F. Dunkerley (Gemini 1a, two Cirrus Minor 2); S/L. J. Rush (Falcon Six, Gipsy Six 1); R. R. Paine (Hawk Speed Six, Gipsy Six 1F); J. N. Somers (Mew Gull 2, Gipsy Six 2).

Venezuelan Canberras

THE third and fourth English Electric Canberras destined for the Venezuelan Air Force left Warton Airfield last Sunday, and arrived in Gander four hours thirty-six minutes later—a time only 18 minutes longer than the Aldergrove-Gander record, also held by a Canberra. The aircraft were due to fly on to Venezuela *via* the United States and Jamaica. The previous two aircraft were ferried out by R.A.F. personnel, but on this second occasion two pilots from Silver City Airways, Capts. J. W. Hackett and R. B. Damon, were at the controls. Capt. Hackett has been in command when Sir Winston Churchill has flown by Silver City.

Telling Britain's Industrial Story

EIGHT British publishers of technical, trade and specialized journals have joined forces to display 55 publications at the Canadian International Trade Fair, Toronto, June 1st-12th. This exhibit, it is expected, will do much to supplement buyers' own impressions of British goods and services. Both *Flight* and *Aircraft Production* will be among the journals displayed.

Mr. D. G. C. Mockridge, an executive of Associated Iliffe Press, is leaving for Canada on May 19th to represent the eight publishers concerned. These companies, with the numbers of different journals they will be showing are : Associated Iliffe Press (24), Temple Press, Ltd. (13), Tothill Press, Ltd. (8), Morgan Brothers (Publishers), Ltd. (5), Machinery Publishing Co., Ltd. (2); Engineering, Ltd., Machinery Lloyd, and McGraw-Hill Publishing Co., Ltd. (1 each).

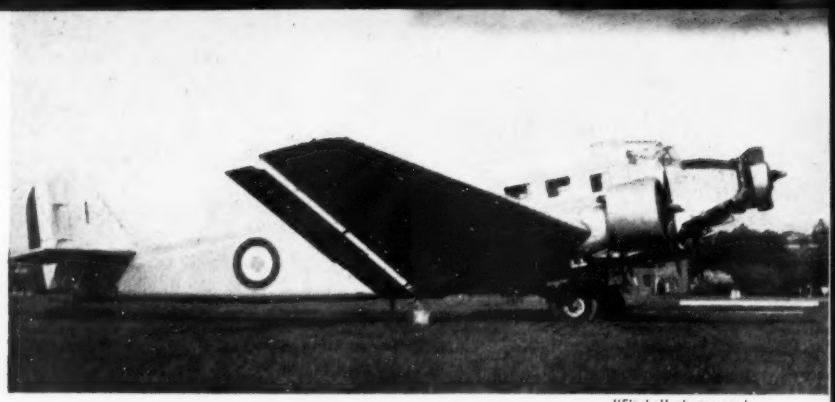
Thames Swanning

FOR the record, we report that on Tuesday, May 5th, Major Christopher Draper, D.S.O., surprised many Londoners spending their lunch hour in the bright sunshine by flying an Auster Autocrat, G-AGYD, under 15 Thames bridges. Approaching water level (the tide was low) over Blackfriars Bridge, outside *Flight* offices, he flew under Waterloo Bridge, over Hungerford railway bridge, and then under Westminster and thirteen more bridges as far as those at Barnes and Kew, which were not included. The pilot then flew back to Broxbourne, where he is a member of the club, and where he had hired the aircraft. With him was a photographer, Mr. J. Matthews.

Major Draper, who is 61, described the flight as a "swan-song to 41 years of flying."

At the risk of appearing pompous we would remark that, in general, we do not approve of stunts of this kind, particularly when personal publicity is one of the objects—though it is impossible not to feel some sympathy for Major Draper, who, according to reports, said afterwards that he was "broke" and had been on the dole for fourteen months. The idea of the flight was to prove that there was life in the old dog yet. Likewise, we must admire the spirit of a man who won his decoration when flying with the R.N.A.S. during the first World War, and at 61 years of age indulged in an escapade of this sort; and it is doubtful whether, contrary to some opinions, any real danger was involved, except perhaps a little to the pilot and his passenger. We have no admiration at all for those busybodies who, on seeing the aircraft, hurried to the telephone to volunteer information to the police.

HERE AND THERE



"Flight" photograph

POST-WAR MODEL: Although the basic design is well over 20 years old, the Ju 52/3m is still doing useful work. This example, photographed at Hendon last week, is used by the French Air Force for transport and communication duties. The designation AACI shows that it was built in France after the war by Ateliers Aeronautiques de Colombes.

Laos Reinforcement

SIX U.S.A.F. Fairchild Packets from Japan arrived at Hanoi, Indo-China, on May 6th, and were expected to be followed by others. They are being used to fly reinforcements and supplies into Laos to stem the Viet Minh advance.

Scottish Avons

THE Minister of State for Scotland, the Earl of Home, visited the new Rolls-Royce factories near Glasgow last week and saw Avons in production. The East Kilbride plant already employs 1,800 workers.

English Electric Fighter?

ACCORDING to reports, which have received publicity on both sides of the Atlantic, English Electric are building "a delta-winged jet fighter." One reference says that it has been ordered by the Ministry of Supply and will appear before the end of this year.

Alma Meteor

SINCE the Gloster Aircraft Company's Meteor technical-instruction school began operations in its present form in September 1949, it has trained 730 Service and civil pupils, mostly on two-week courses. Commonwealth and foreign countries which have sent pupils include Australia, Canada, France, Holland, Belgium, Denmark, Egypt, Pakistan, Persia, Syria, and Brazil.

More for the Garden Party

SOME further notable aircraft—additional to those mentioned in our issue of May 1st—are now announced by the Royal Aeronautical Society as being scheduled to appear at its garden party at Hatfield on June 14th. Both historic and modern, they include a B.A.C. Drone, 1933 Avro Cadet, Jean Batten's Percival Gull VI, Vickers Wellington, Avro York and Lincoln, Armstrong Whitworth A.W.52 "flying wing," an English Electric Canberra and an Avro 707. The U.S.A.F. will contribute Thunderjets and Sabres and the U.S.N. an Expediter and an R4D-8 (Super DC-3). Among the exhibits will be the Frost steam aero engine of 1910 and a Hucks starter. Admission is confined to R.Ae.S. members and their guests.

"Hey, Ernie, somebody's pinched it."

Air-mapping Housing Sites

AIR photographs were taken of the Bradway district of Sheffield recently, as part of an extensive aerial survey of the city for housing purposes.

Whitsun at Waterbeach—

OVER 400 clubs will take part in the 1953 British National Model Aircraft Rally at R.A.F. Station Waterbeach on Whit Saturday and Sunday (May 23rd and 24th), and some 1,000 entries are expected for the nine major contests. Waterbeach is situated six miles N.E. of Cambridge.

—at White Waltham—

A NUMBER of women pilots, including three from the W.R.A.F.V.R., who will do formation flying, will take part in the air display being held at White Waltham by the Women's Junior Air Corps on Whit Monday, May 25th. Mrs. Ann Douglas will give a radio-broadcast gliding lesson to a W.J.A.C. cadet, and Miss Phyllis Weir will make a parachute descent. Service support by both R.A.F. and Naval aircraft has been promised for the display, which will begin at 2.30 p.m.

—at Yeadon—

IT is expected that over 50 aircraft of four nations will take part in the big Whit Monday display at Yeadon, near Leeds, in aid of the S.S.A.F.A. The R.A.F. is providing Canberras, Meteors (609 Sqn.), a Venom and a Sunderland, and the Navy is to send Attackers, Sea Furies and a helicopter. It is hoped that the U.S.A.F. will stage an air-refuelling demonstration; an R.C.A.F. Sabre may try for a sonic bang; the French Stampe Squadron will perform, and from Spain will come that aerobatic individualist, Prince Cantacuzene. The show begins at 2 p.m.

—at Elmdon—

THERE is a most comprehensive programme for the Whit Monday display at Elmdon (Birmingham), beginning at 2.30 p.m. and continuing until late in the evening; events will include aerobatic and other demonstrations by Meteors (609 Sqn.), Canberras, an A.W. Meteor N.F.11, Shackletons, a Venom, Seafires, a helicopter, and U.S.A.F. and R.C.A.F. Sabres. Prince Cantacuzene will perform, and a Comet may fly over.

—but Not at Derby

THE Derby Club's display, fixed for Whit Saturday, has been indefinitely postponed.

For Midland Enthusiasts

IN association with Birmingham Aircraft Recognition Society, Birmingham and District Aviation Club is to hold a free-for-all film show at the International Centre, Suffolk Street, at 7.30 p.m. next Thursday, May 21st. Mr. Gerald Pollinger, A.R.S. hon. secretary, will give an introductory talk.

Aerostat

THE world's largest hydrogen balloon, manned by four members of the Hague Balloon Club, is to ascend from the Royal Hospital, Chelsea, grounds during a fête on June 6th. The crew hope for winds that will take them back to Holland. Procea Products, Ltd., are sponsoring the flight.

Norway's Jet Squadrons

THE Royal Norwegian Air Force is to put three new squadrons of F-84s into commission in the very near future; the C-in-C., Gen. F. Lambrechts, said recently that the aim was for eight jet fighter squadrons by July 1st, 1954. He added that three new airfields would soon be ready, at Bodo in Northern Norway, at Orlandet near Trondheim, and at Rygge in Southern Norway. A number of other airfields are under preparation.

U.S.A.F. Prestwick Expansion

WORK has started on a contract worth "several million dollars" for the construction of a big new American Air Force base at Prestwick Airport. The new camp—to be known as Greensite—will cover 40 acres, ten times the area now occupied by the Americans at Prestwick. U.S.A.F. personnel at present occupy the heart of the airport terminal area, but when the new camp is completed only operations, traffic, signals, and weather staff will stay in the main buildings. The Prestwick unit handles the steady flow of military transport and other aircraft to Europe.

Honoured

THREE Britons will be among 23 recipients of the first Paul Tissandier Diplomas of the F.A.I., to be presented during the Federation's Congress, which opens today at the Hague. The three are Capt. J. L. Pritchard, secretary of the R.Ae.S. from 1925 to 1951; C. G. Grey, aeronautical journalist since 1907; and A. F. Houlberg, president of the F.A.I.'s model aeronautics commission. In memory of the pioneer airship constructor Paul Tissandier (first secretary-general of the F.A.I., 1905-45), the diplomas are to be awarded to those who, not eligible for F.A.I. Medals, have served the cause of aviation in general and of sporting and private flying in particular. Each F.A.I. member-country nominates three candidates.

Sapphire-powered aircraft are the keystone of Western Defence

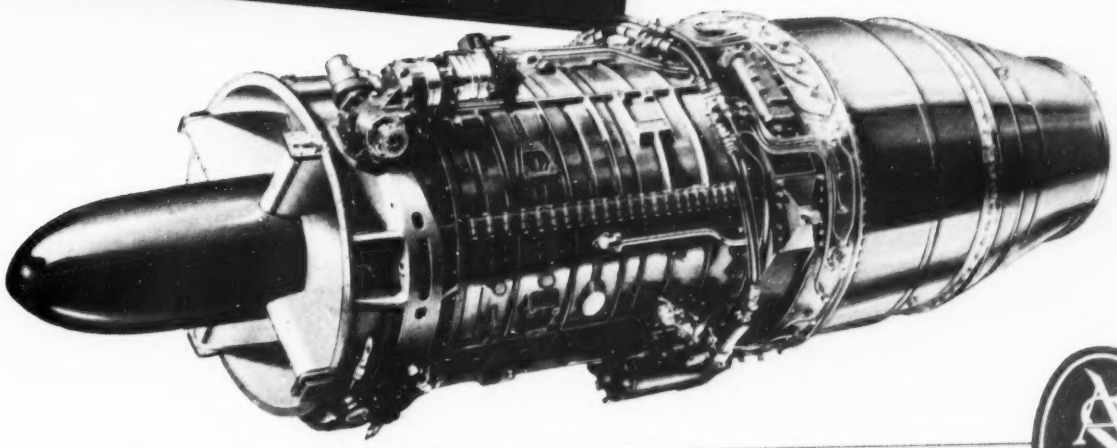
The Sapphire-engined Hawker Hunter F.2 fighter for the Royal Air Force is but one example of the part played by the Armstrong Siddeley Sapphire in the defence plans of the Western world.

The Gloster Javelin all-weather fighter and the Handley Page Victor bomber are also powered by the Sapphire turbojet while its American version the Wright J.65 powers the Republic F.84F Thunderstreak and the Martin B.57 (Canberra).

ARMSTRONG SIDDELEY

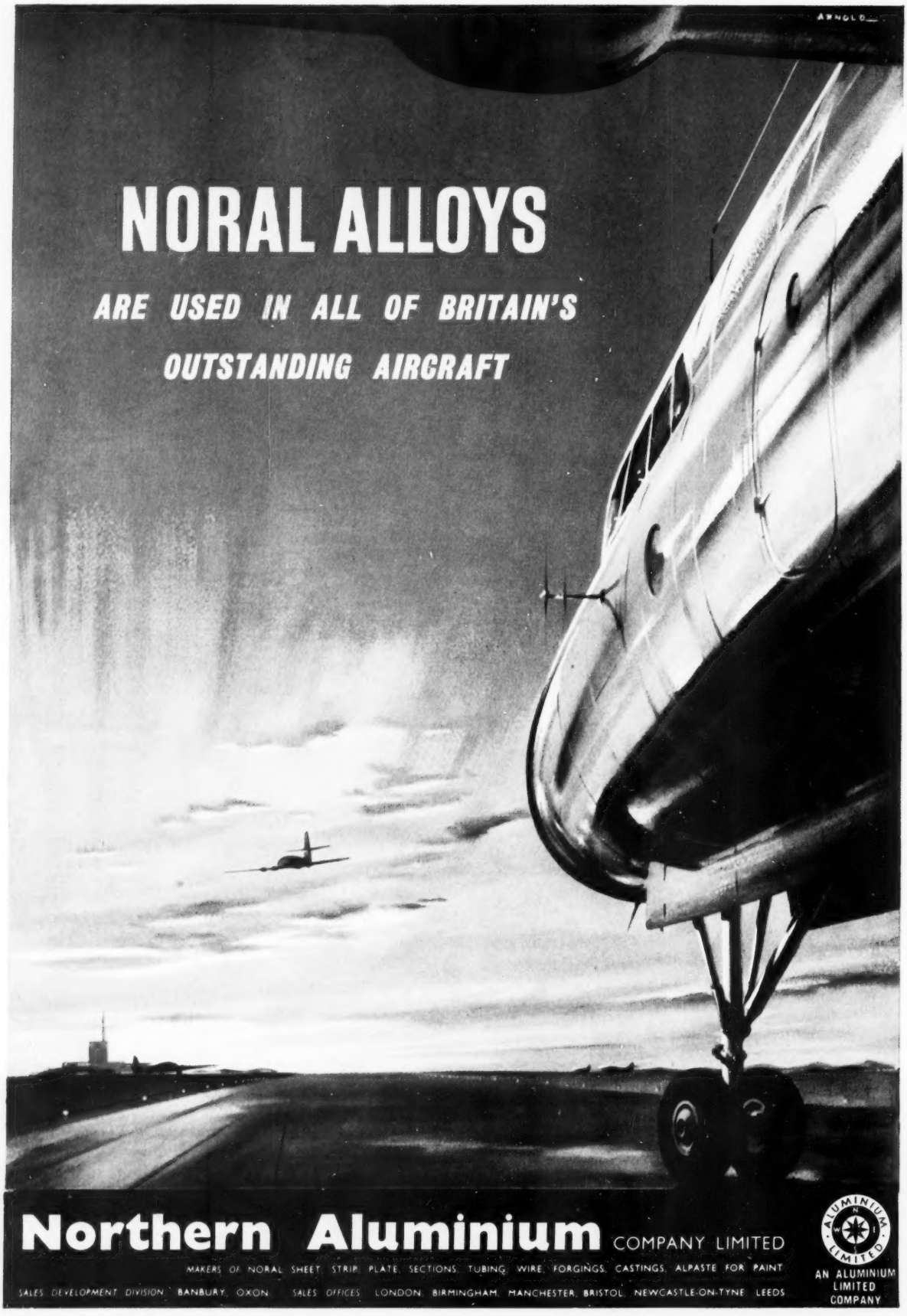
SAPPHIRE

TURBOJET



ARMSTRONG SIDDELEY MOTORS LIMITED • COVENTRY

Members of the Hawker Siddeley Group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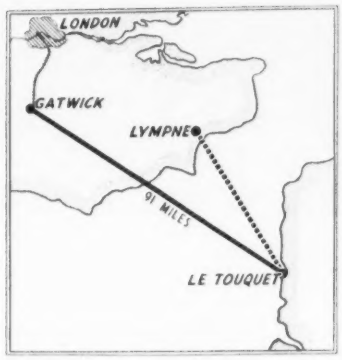
GATWICK to LE TOUQUET

SILVER CITY AIRWAYS are to open yet another new service on May 15th. Using their new "Super - Freighters," there will be two round trips daily between Gatwick and Le Touquet. A "lunch" service takes-off ot 1230 hr, and the "dinner" flight at 1630 hr. Trains depart Victoria station 62 minutes earlier, and Le Touquet is reached 102 minutes after leaving London. That this will undoubtedly be the quickest route to the Continent was convincingly demonstrated by a recent proving flight on which we were able to travel.



Gatwick Airport station, of course, provides the well-nigh perfect connection between ground and air transport, and with formalities quickly completed, 20 critical passengers were very soon aboard 'MWB : the second of the Mk 32 Freighters. In addition to the filled passenger cabin, "Willy Baker" bore three export Austin Sevens, with plenty of space to spare in the 37ft hold.

Cabin furnishing, while still austere by "mainliner" standards, is perfectly adequate for this scheduled 40-minute trip, and is a considerable improvement over that of the earlier aircraft. The bulkhead dividing cabin from hold may be moved 4ft 9in to the rear, thus providing a clear 42ft of hold for a loss of eight of the rearward-facing seats.

Take-off performance remains excellent on this latest version of what is fast becoming a perennial aircraft, and we were assured by Captain Madelaine—the company's senior pilot—that in most respects the Mk 32 is superior to its predecessors. The extra weight and drag of all modifications is amply compensated by the extra power available from the Hercules 734s. Forward view is unaffected by the lengthened nose, which can be seen by only the tallest of pilots.

These proving flights achieve much more than at first meets the eye. On this occasion, after a wind-assisted flight of only 35 minutes, the Silver City party was entertained in Le Touquet by the mayor, M. Pouget, who said how pleased he was to see this new service in the offing, bringing as it surely will increased business to his town. The long-established car-ferry services have used the airfield as a convenient dropping-off point; now it is hoped more people will come to stay in Le Touquet itself. The municipality is certainly doing all within its power to encourage such traffic, by improving the airfield and its facilities to the tune of some £400,000. One new runway involves a five-mile diversion of the Le Touquet-Etaples road. The French, with their typical uninhibited outlook, seem to take such things in their stride.

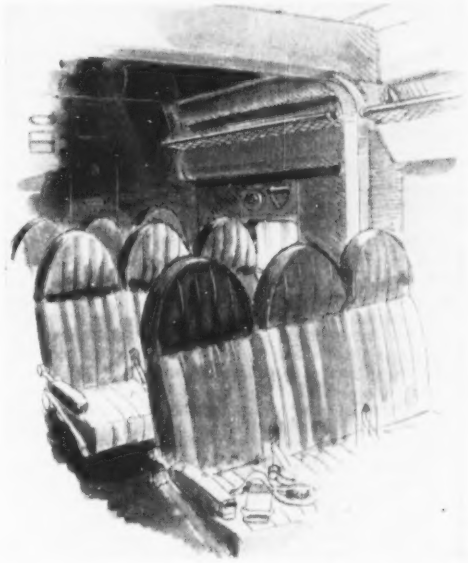
Initial climb on the 40-minute return flight was spectacular, there being now only one car aboard. The crossing, in both directions, was made at 2,000ft at an I.A.S. of 130 kt.

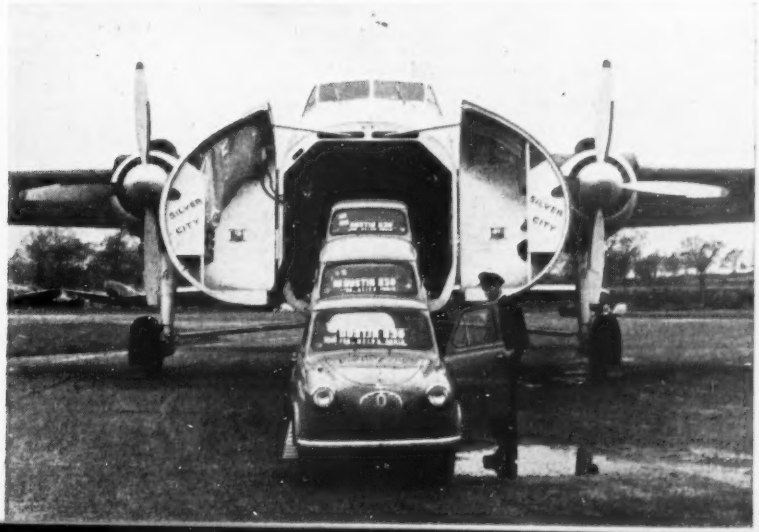
We felt that everything about this long-nosed Freighter is going to be good for the "first time" passenger, of which the company carries a large number. Particularly is this true of the ample cabin headroom and the resultant "anti-claustrophobic" atmosphere.

It will be seen from the accompanying map that the air distance, 91 miles, is just double that of the Lympne to Le Touquet route. Charges for vehicles are naturally higher; therefore, say Silver City, the Gatwick service is not primarily a replacement for the Lympne car ferry but is first and foremost a passenger service on which cars, motor cycles and pedal cycles will be carried as and when necessary. A.B.

"Flight" sketches

"Forward view is unaffected by the lengthened nose, which can be seen by only the tallest of pilots." (Below) "Cabin furnishing . . . is perfectly adequate for a 40-minute trip."



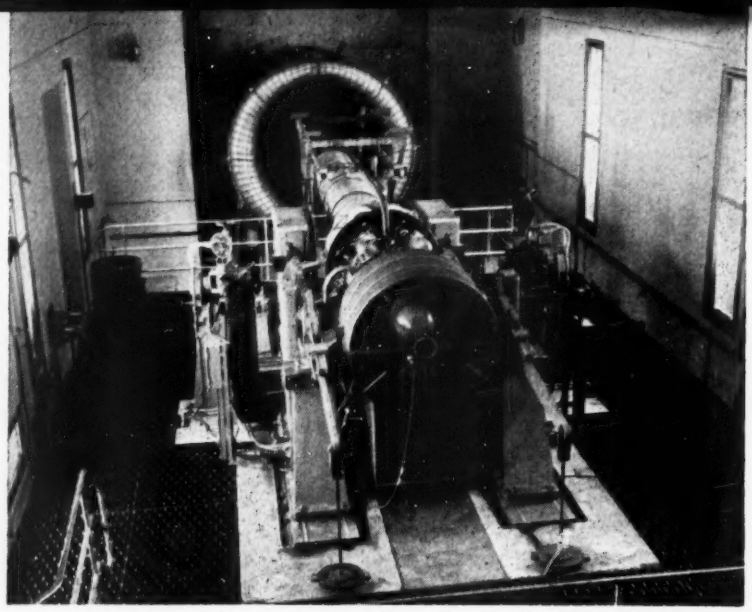


With its large freight-hold, the new "170" is capable of carrying three small cars instead of two. These Austin Sevens—the first of their make to be exported by air—were carried on the proving flight described.

E

AVON TESTING

New Heenan and Froude Test-Beds at Coventry



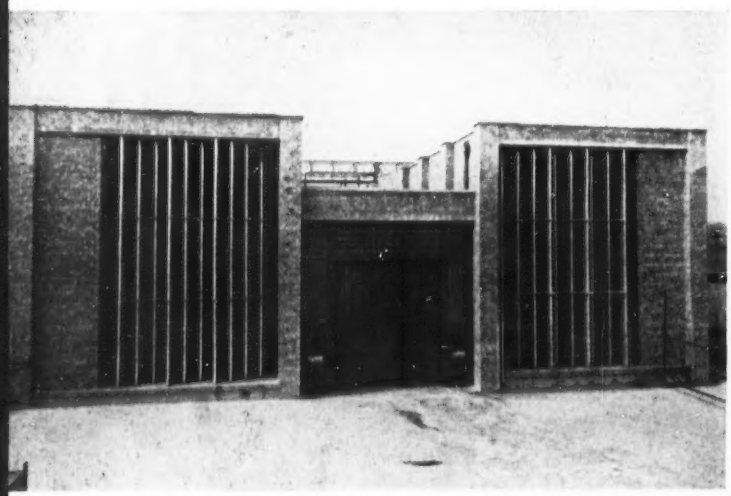
An Avon mounted in one of the test-beds. To the beams at the intake end a known thrust can be applied by means of weights, to check the accuracy of the thrust readings. The control room is on the left.

IN company with certain other firms, the Standard Motor Company, Ltd., are co-operating with Rolls-Royce in the manufacture of the Avon engine as part of the national engine supply programme. At the Standard works at Coventry, two comprehensive test-beds for these engines have been installed by Heenan and Froude Ltd. and were recently visited by *Flight*.

These test-beds are similar to others being built by Heenan and Froude for D. Napier and Son, and for an extension factory of Rolls-Royce, both also engaged in Avon production, and the whole contract represents the first quantity production of large-scale test equipment for a turbine engine production programme. The thrust-cradles of the Coventry installation are stated to be equally suitable for the Bristol Olympus, de Havilland Ghost and Goblin, and Armstrong Siddeley Sapphire engines, as well as for more powerful units of the future.

The layout of the Standard installation was influenced considerably by the need to use existing buildings. These premises had been erected during the last war to house Heenan hangar stands for testing the Bristol Hercules engines which the Standard company produced under the "shadow-factory" scheme. In these plants the engines were mounted on nacelles some 10ft above floor level (as the engine power was absorbed by large-diameter airscrews), and the control room was elevated accordingly. The same position of control rooms was retained for the new turbine engine installation. As this form of construction provides a clear space below the control room floor, the opportunity was taken to instal there a battery room and to house the CO_2 fire-extinguisher bottles and other equipment.

The building is in the form of a capital letter H, housing two plants and having a common double control room. The space at one end is roofed over to form a rigging shop where engines are prepared for erection on the cradle, and care has been taken to reduce the change-over period between engine installations to as short a time as possible.



On each side of the main entrance to the Coventry test house are the Muffelite splitters; through these the air enters the two test-beds, which extend back on either side of the central control room.

The basic essentials of the plant are : (*a*) a thrust cradle, on which the engine is bolted and arranged so that the thrust is transmitted to accurate measuring gear, remotely situated in a control room; (*b*) means of storing, supplying and measuring the fuel consumed by the engine; (*c*) a control panel, placed behind an observation window in the control room, with measuring instruments and controls; (*d*) ventilating and heating plant, fire-fighting equipment, engine accessory loading equipment, and other auxiliary plant; (*e*) sound-proofing. These items are described in more detail below.

The engine thrust cradle is large enough to take bigger engines than the Avon, and is capable of dealing with greater thrust than is actually developed by that unit. (Maximum stated thrust for the Avon is 7,500 lb without re-heat.) The engine is fixed by brackets to a channel-section framework, which is suspended in such a way that it can move freely in an axial direction, but is resistant to sideways movement. The suspension is by means of steel strips, by which the cradle is hung from heavy cast-iron pedestals.

To cater for cases in which the hot gases do not leave the jet-pipe in a truly axial direction, both sides of the cradle are connected to its thrust-resisting levers; any difference in the forces on each side is compensated by coupling the two sets of levers together by a strong torsion-shaft.

The final lever of the cradle is connected to the thrust-measuring weighing machine by pull-rods. By suitable leverage ratios, the force reaching the weighing machine is reduced to one seventy-fifth of the thrust exerted by the engine.

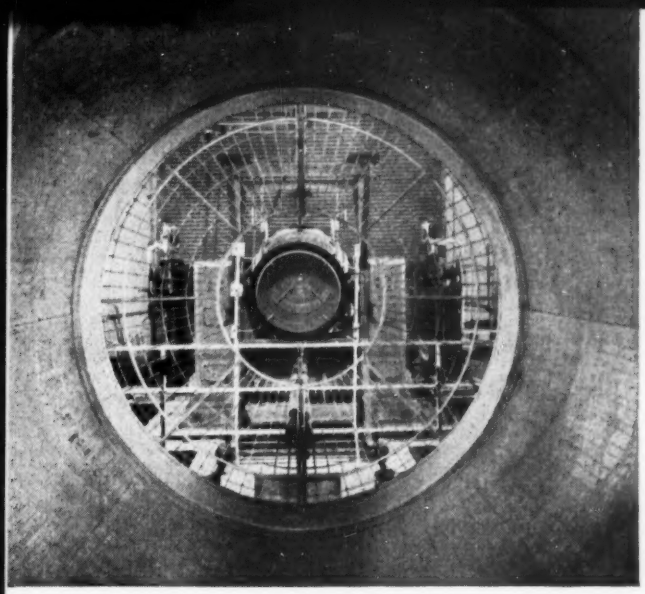
The thrust weighing machine itself is in the control room. It is an Avery pendulum (springless) weigher, and is connected to the final pull-rod lever by a length of high-tensile steel wire of only 5/32-in diameter.

To check the accuracy of the readings, checking gear is provided by means of which any desired thrust can be imposed on the cradle. This imposed thrust, applied by weights, is itself known with great accuracy, and thus the readings of the main weigher can be checked very closely. This checking process can be carried out very quickly.

Heenan and Froude were expected to ensure that any error in readings did not exceed one-tenth of one per cent at maximum load. This aim was in fact surpassed, and on a typical check test the average inaccuracy amounted to only 0.0225 per cent.

The fuel-system main storage tanks, each holding 12,000 gallons, are sunk in a pit outside the test-house buildings. From here fuel is pumped to each plant by Wayne centrifugal pumps, driven by flameproof motors, and similar unloading pumps are also provided. The pumping system incorporates tank contents gauges, filters, recording flowmeters, and de-aerators; all this equipment has been supplied by the Wayne Tank and Pump Co., Ltd.

Each test plant embodies a fuel cubicle, constructed in brick as part of the main building so as to enclose and isolate it as a safety precaution. Each cubicle contains a mild-steel structure carrying Rotameters for instantaneous readings of fuel flow, an Avery-Hardoll flowmeter with timing unit, and a Brodie-Kent flow-meter for reheat-fuel flow. Negretti and Zambra dial-type mercury



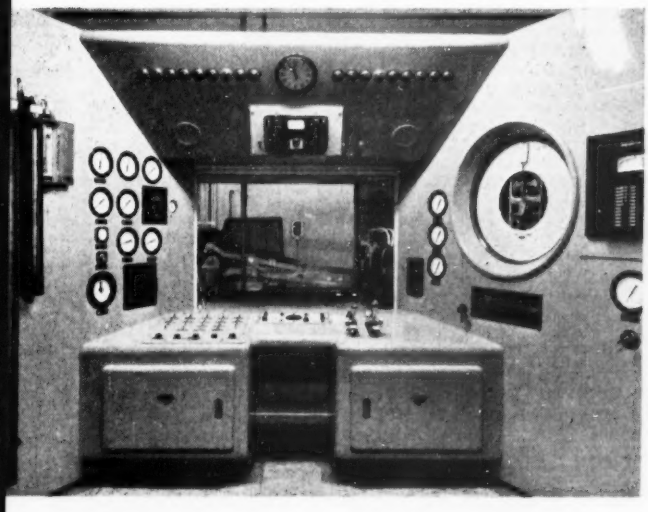
Looking back through the diffuser into the Avon jet-pipe, four bi-metallic thermocouples for jet-pipe temperature measurement can be seen. The position of the diffuser itself is longitudinally adjustable, to accommodate varying jet-pipe lengths.

thermometers and transmitting-type pressure gauges, a Vokes filter, a hydrometer, and an electrically operated magnetic stop-valve are also provided, while heat-resisting glass windows permit observation. Other items include a fuel reclamation tank and contents gauge, and a Rellumit filter, fitted in the fuel feed line at the engine cradle.

The control panel, of neat, pleasing appearance, is made of folded and welded steel plate. It is fitted with fuel and throttle levers, and a large array of instruments. Where the piping or cabling of these fittings passes through the wall into the engine room it is packed with sound-insulating material in a wall-box. A steel-plate manifold is fitted on the engine cradle to form a neat and convenient station from which the permanent piping etc., can be coupled up to the particular engine to be tested. From the control room all operations and tests are directed, a large double-glass window permitting observation of the engine.

A comprehensive system of fans and ducting ensures the constant removal of all fumes from engine and control rooms, pump house, and battery room. Special extracting fans with flameproof motors enable air to be continuously sucked through the fuel cubicles, this air being warmed to 70 deg F by heaters. Suspended heat-diffusers and high-level heating coils provide adequate working temperatures in the rigging shops, control room and elsewhere.

The neat design of the test-bed controls is well shown in this view. Tubes on the extreme left indicate jet-pipe static head, jet-pipe total head and oil sump pressure; on the right-hand side of the central desk are fuel and throttle levers, and on the right-hand wall are the large, circular thrust indicator and the selective temperature indicator.



The fire-fighting equipment consists of a piping system arranged to distribute CO_2 to stragetic points in the engine room, fuel cubicles, battery rooms, and fuel pump house. The system is provided with pull handles and automatic change-over switches (interlocked with the CO_2 pipework) to shut off the fuel supply, switch off the fan motor of the ventilating plant, and sound an alarm.

To provide means of testing the engine auxiliary take-off drive, two small Froude dynamometers are fitted to each engine cradle, one on each side, with Rotol special drive-shafts. A small Heenan water-cooler continuously cools and recirculates the heated water leaving the dynamometers.

A two-ton travelling pulley-block, with runway, was supplied for the engine room, together with a runway for a hoist in the diffuser exhaust chamber (forming part of the sound-proofing). The soundproofing was installed by Cementation (Muffelite) Ltd., using an exhaust-gas diffuser developed by the Bristol Aeroplane Company and manufactured (with the exception of the flared inlet) by Heenan and Froude.

On leaving the jet-pipe, the exhaust gases are led into the inlet of the large steel venturi or diffuser, where a considerable volume of cool air is entrained, reducing the gas temperature. At the end of the diffuser a large "basket" spreader is fitted, to break up and spread out the gas stream, which then passes through sound-absorbing dog-leg "splitters" in the final outlet passage to the atmosphere. Similar splitters are used at the air inlet to each engine room. A similar installation was described in *Flight* of December 12th last.

Owing to the large volume of air consumed, the areas of the air passages and of the soundproofing materials are extensive. Specially constructed doors are used for communication between quiet and noisy areas; the roof and walls of the exhaust chamber are lined with felted mineral wool, held in position by corrugated aluminium sheeting, and acoustic tiles are incorporated in the control room.

In the case of the Heenan plants for Rolls-Royce and Napiers, a different form of soundproofing is specified, supplied in this case by Horace W. Cullum and Co., Ltd. Instead of passing through a diffuser and thence through vertical splitters, the exhaust gases flow directly into a Cullum Detuner in which they are gradually expanded; this Detuner is constructed of sound-proofing materials, and is of circular cross-section with internal annuli. This system was described in *Flight* of September 5th last.

The layout of these test plants themselves is also different, as the engines are tested at ground-floor level, and the control room is in line with (and slightly above) the engine instead of on one side. The general construction is, however, substantially the same as that of the test-beds at Coventry.

IWO JIMA ON T.V.

SOME excellent combat camera-gun shots introduced *Target Suribachi*, Episode 23 of the B.B.C. Television Film, *Victory at Sea*. These were taken during fighter sweeps against the Tokyo airfields Katori and Mobara, and against aircraft factories, trains and shipping, and were remarkable for their clarity. It was difficult to appreciate that they were taken under the stress of battle. Shots of B-29 raids on Tokyo included cuts from Japanese newsreels showing civilians scurrying into air-raid shelters and views of some of the big fires started by incendiaries.

The film also covered the attack on Iwo Jima. This minute island, about 800 miles south of Tokyo, was required as an advanced fighter base, so that the B-29s based in the Marianas could mount really effective raids against the Japanese mainland.

Some of the most exciting sequences yet seen in the series were those of a Typhoon enveloping the invasion fleet on its way to the island. Very heavy spray could be seen sweeping over Corsairs which, parked on wildly pitching carriers, seemed to be suffering considerable damage.

In spite of a tremendous naval bombardment—most vividly portrayed—and air attacks for 72 consecutive days, the deeply dug-in Japanese were little affected and fierce fanatical opposition greeted the advancing Marines. In fact, nowhere else in the Pacific did the softening-up arrangements get such a black eye as on Iwo. But the 5,563 who died before the island was won did not die in vain, for before the war ended no fewer than 2,251 B-29s and over 24,000 aircrew were to be saved by emergency landings on the little island.

The Road to Mandalay, Episode 24, stressed the difficulties of supplying China when the Japanese cut the Burma Road and covered the opening of the alternative route from Ledo to Lashio. Apart from a mention that 47,000 tons of munitions a month were flown on the famous airlift over the famous "hump," there was little air interest in this episode.

MEDICAL ASPECTS of AVIATION

Authoritative Views on Some Current Problems in Civil and Military Flying

NOW that air travel is becoming so universally popular, whilst at the same time the scope of military flying is ever enlarging, the need for full understanding of the medical problems associated with flight becomes increasingly great. That those professionally concerned are very much alive to this fact is apparent from recent literature. A series of authoritative articles has lately appeared in two journals of the medical profession, and in the following pages we have summarized a number of the views therein expressed. In order to make the matter easily understood by the layman, medical terms have so far as possible been omitted.

The first section, on some aspects of air-travel physiology, is a combined digest of views expressed in articles which recently appeared in the *British Medical Journal* (author, Sir Harold E. Whittingham, K.C.B., K.B.E., Ll.D., F.R.C.P., Director of Medical Services, B.O.A.C.) and *The Medical Press* (author, A. V-M. E. D. Dalziel Dickson, C.B., C.B.E., M.D., F.R.C.S.E., Q.H.S., Senior Consultant in Otorhinolarynology, R.A.F.).

The remaining five sections, by the authors named under each heading, are all digests of articles which appeared in a recent issue of *The Medical Press* devoted mainly to aviation medicine. For permission to make all these summaries we are indebted to the two journals concerned.

AIR-TRAVEL PHYSIOLOGY

EARS AND SINUSES: Air locked in the middle ears at ground level is able gradually to escape down the Eustachian tubes as external pressure decreases with altitude; on descending, however, this process does not take place automatically, but can normally be contrived by swallowing, yawning or "blowing" with nose and mouth closed. A danger that is not so well recognized, however, is that if this artificial clearance is left too late, so that a pressure differential in excess of 80-90 mm Hg is set up, no amount of effort will suffice to open the offending Eustachian tubes. Relief can only then be obtained by a return to altitude—which may or may not be possible.

The condition caused by failure to equalize pressure on either side of the ear drums is called otitic barotrauma. It may cause acute ear-ache, deafness and even vertigo: damage to the ear may include temporary distention, haemorrhage or, in extreme cases, rupture of the drum-head. Young children automatically avoid trouble, unless their aural passages are congested with catarrh, because the pain of the middle-ear air pressure causes them to cry, so opening the Eustachian tubes. It is suggested that babies be allowed to feed or to suck dummies during descents. An amphetamine inhaler is recommended for anyone with a head cold.

Sinus troubles are of much rarer occurrence than those described above: they are at their severest during descent, when sudden, severe pain may occur, starting above the eyes and working down towards the upper teeth. Crying, and discharge of blood through the nose, usually take place.

Noise in aircraft can be harmful to the ear over a long period of time. The average human ear can hear sounds within the 32-20,000 c.p.s. frequency range. Prolonged noise in excess of 90 decibels (the intensity of very heavy traffic, or blaring indoor radio) may affect the reception of sounds of certain frequencies. The effect is initially temporary, but continued exposure makes it permanent. If enough frequencies are affected, appreciation of speech may become difficult. Ear wardens or helmets are effective in keeping out sound, but cotton-wool plugs are useless unless impregnated with grease.

Soundproofing has proved particularly effective in jet aircraft, in which most of the sounds are of high frequency, and thus readily cut down by the absorbent material. There is no evidence whatever at the present time that the ultrasonic vibrations associated with jet engines have the slightest physiological effect on the ears or the nervous systems of human beings.

Airsickness.—Apart from psychological effects, the causes of air sickness are bumpy weather, anoxia (lack of oxygen), fatigue, noise and vibration. Hyoscine hydrobromide or antihistaminic pills constitute preventatives that work admirably for the vast majority of people.

Immunization against Diseases.—Few problems arise over this, but it may be of value to quote a convenient time-table for a full quota of innoculations prior to an overseas tour: First day—yellow fever, cholera, T.A.B.; fourth day—smallpox vaccination; seventh to ninth day—T.A.B. second dose.

Invalids in Civil Aircraft.—In general, there is no reason why invalids or very old people should not travel by air; indeed it is frequently the best way for them to cover relatively long distances, especially now that pressurization and high-altitude flight provides such a comfortable ride.

There are certain types of invalid, however, who should not travel by air: these include those with anaemia (lack of red blood cells), who readily suffer from anoxia; women more than eight months pregnant; diabetics, unless they can administer insulin to themselves; ulcer patients; and of course anyone with infectious, contagious or odoriferous diseases. Above all, sufferers from heart ailments must be very careful to take medical advice before entrusting themselves to an aircraft, and those with respiratory disorders would also be well advised to take such counsel.

All major airlines can provide oxygen facilities for invalids, and will make special arrangements for them in flight and at *en route* stops, provided prior notice is given. Stewards and stewardesses are first-aid-trained; if anything too serious occurs, pilots are abe to radio ahead for advice, or for medical assistance to be available on landing.

PROBLEMS OF VISION

(Summarized from an article by A.Cdre. J. C. Neely, C.B.E., D.M., Q.H.S., Consultant in Ophthalmology to the R.A.F.).

FROM the point of view of the airline passenger, visual problems are not of great concern, but the effects that may arise for aircrew, and particularly for pilots, are considerable. First, there is the question of speed of vision. The minimum time required for the eye to go through the complete cycle of focusing on cockpit instruments, then on an external object, and finally back on to instruments again, varies between one and two seconds according to the individual. In this time an average aircraft making a blind approach will have travelled between 75 and 150 yards, whilst a high-speed military machine taking low-level evasive action may well have covered more than a quarter of a mile. Well-trained pilots, with quick-focusing eyes, are therefore an essential.

A second problem is short-sightedness (myopia) at altitude. In the cloudless bowl of the sky at, say, 40,000ft, there is no distant object on which the eye can focus, and under these circumstances it automatically adjusts itself to a focus about midway between distant and near vision. This means that picking out other aircraft at such altitudes is not as easy as it is nearer the ground.

From the point of view of landing, the most important ocular characteristic is now thought to be good visual acuity, i.e., sharpness of vision. This is in contrast to an earlier theory, which considered that a tendency to land high, or alternatively to fly the machine into the ground, was due to faulty ocular muscle balance (heterophoria, or latent squint). Nearly everyone suffers from heterophoria to some slight degree, but those with pronounced characteristics are unsuitable as pilots, not because of potential landing difficulties, but because the wrong alignment of the eyes makes them prone to eyestrain, which is likely adversely to affect their general flying.

Inadequate colour vision is a familiar sore point with many would-be aircrew. Very few people are acutely colour-blind, but a considerable number are unable to pass the strict tests laid down, such as that of the well-known Ishihara pseudo-isochromatic plates. Standards, incidentally, were lower in the war than in peace-time—and, it may be added, many pilots whose colour vision was only up to war-time standards fought with considerable success.

Optical illusions can easily occur in flight, involving apparent movements of objects, and may easily have serious results. Such illusions can result, among other causes, from changes in direction of flight, and from gazing too long at a dim external source of light.

Anoxia at altitude has an adverse effect on night vision, which it may reduce by as much as 50 per cent at 17,000ft. Colour sense and stereoscopic vision are not affected, but focusing power may be.

DECOMPRESSION SICKNESS

(Summarized from an article by W.C. H. L. Roxburgh, M.B., Ch.B., of the R.A.F. Institute of Aviation Medicine, Farnborough.)

DECOMPRESSION sickness is the condition brought about by exposure to low pressure, either at great altitudes or in a decompression chamber. Various symptoms may be exhibited.

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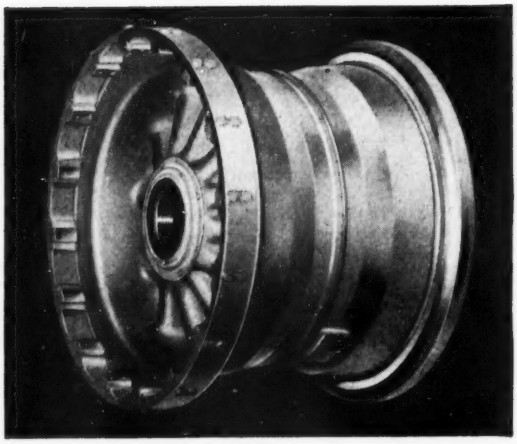
B R I T I S H E U R O P E A N A I R W A Y S

New wheel unit for 'Argonaut' shows 800% longer service life

GOODYEAR WHEELS GIVE 9,600 MORE LANDINGS

A STRIKING operating economy has recently been made for the British Overseas Airways Corporation. Their "Argonaut" airliners, serving Near and Far Eastern routes, are equipped with single disc wheels and brakes designed and manufactured by the Aviation Division of the Goodyear Tyre & Rubber Co. (G.B.) Ltd. They give 9,600 more landings than the assemblies previously in use.



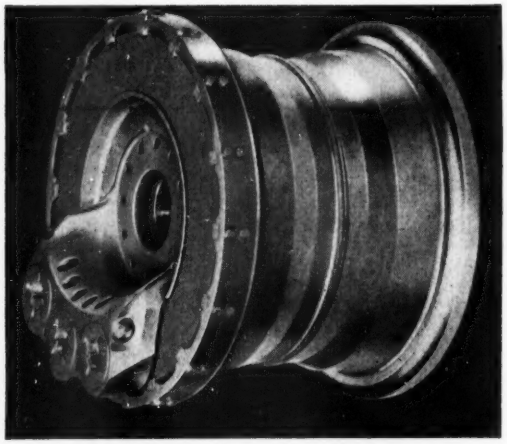
The Goodyear wheel as fitted to B.O.A.C. Argonauts. The wheel is cast from magnesium alloy and is of divided construction incorporating inboard and outboard halves. This greatly facilitates mounting and dismounting tyres.

LESS SERVICING NEEDED

In addition they require the minimum of servicing. The assembly is designed so that the brake clearance remains constant throughout the whole life of the linings. Adjustments are therefore unnecessary.

This is one instance of the way in which wheels and single disc brakes designed by Goodyear combat increased operating costs, whilst giving more satisfactory service.

The Goodyear Aviation Division will help you solve your landing gear problem, too. Technical representatives are always available to give advice, or to join in consultation with your own design staff. They will help you see the job right through, from the drawing board to installation and servicing.



Wheel and brake form a unit which gives many more landings, every one safe because of automatic adjustment of lining clearances. Servicing requirements are less frequent and are carried out more quickly.

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MEDICAL ASPECTS OF AVIATION . . .

Bends are pains in the joints or muscles, which may be mild or excruciating. They are increased by movement, and unaffected by morphia. *Chokes* is the term applied to a condition of respiratory pain and proneness to coughing which can lead to air hunger and collapse. It is a serious condition. *Collapse* can also take place by itself, accompanied by pallor, sweating, nausea and giddiness. *Other symptoms* include dimness of vision associated with migraine, skin irritations, abdominal distensions, and a general sense of unease with inability to concentrate.

In the vast number of cases, recompression will effect an immediate and permanent cure, but—inevitably—there are a few who suffer from after-effects. These may be mild, but "post-decompression shock" can be severe or even fatal unless treated properly, i.e., as for normal shock.

The cause of the trouble is, at any rate largely, the development of bubbles of nitrogen within the body as a result of low external pressure Nitrogen is normally in solution in the tissues and fluids of the body at a partial pressure corresponding to that of the atmosphere; when this external pressure drops, nitrogen bubbles form, notably in those regions where blood supply is least and nitrogen content greatest.

Onset of symptoms are affected by a number of factors. Below 25,000ft the condition is rare, above that the chances of it increase rapidly. Time spent at height is of more significance than actual altitude, within reason. Age has a pronounced effect, subjects in the 35-47 age-group having proved to be about five times more susceptible than those under 25. Fatness is another unfavourable characteristic, because nitrogen dissolves readily in fat at atmospheric pressure, whilst the blood supply in such deposits is very poor. Temperature and rate-of-ascent appear to have negligible effect, whilst residence at high altitudes naturally implies low free-nitrogen content of the body, and hence is conducive to reduced effects at altitude whilst flying.

Prevention of decompression sickness can be effected by pressurization, by selection of suitable aircrew, and by denitrogenation. The last-named can be achieved by breathing pure oxygen for two or three hours at ground level before take-off, thus forcing the nitrogen normally dissolved in the body to leak away *via* the lungs. The method has value for experimental pilots, but is impracticable for operational aircrew.

PSYCHOLOGY OF OPERATIONAL FLYING

(*Summarized from an article by W/Cdr. J. S. Howitt, A.F.C., M.R.C.S., L.R.C.P.*

THE total psychological load on a modern pilot is considerable, and is made up of the mental work done in the performance of the job in hand, together with the mental tension attendant on the results of that work. The subject—considered largely in the light of fighter operation—can conveniently be examined by dividing it into five sections.

Weather Conditions and Instrument Flying.—Bad weather has always imposed considerable fatigue on a pilot, who has to co-relate the readings from his six blind-flying instruments, apply radio or radar information and keep an eye on the rest of his dials. Now, with a nearly all-weather Air Force and modern aircraft that occasion both high speed and rapid rate-of-change of altitude, the problem has become accentuated. The standard blind-flying panel can no longer be considered entirely satisfactory, and there seems to be a case for the introduction of a Zero Reader type of system. Formation flying in cloud is another factor which adds considerably to the total strain on a pilot under bad weather conditions.

Range, Fuel and Navigation.—The jet fighter has a fair range but little endurance, which means that the pilot cannot afford to get lost, nor can he hang about for long in a landing "stack." Yet he operates at great altitudes from where map-reading is usually impracticable, and is frequently solely at the mercy of his radio equipment. Duplication of radio alleviates the problem, but clearly the need has arisen for specially designed aids for single-seater aircraft, and these are, in fact, being developed.

High Altitude.—Flying an aircraft to its operational limit at great altitude, where the gap between critical Mach number and stalling speed is at its narrowest, is a tricky business. It is a simple matter to lose one's companions in a turn, and once this has happened it may be very difficult to regain formation. Another risk is that of pressurization failure, with all its attendant dangers, not the least of which is the fact that it will entail a substantial reduction in height with a corresponding reduction in remaining endurance. [Special flying suits which inflate in the event of cabin pressure failure have been developed in America and in this country to offset the effect of rapid decompression at extreme altitudes, which would otherwise be fatal.—ED.]

Another hazard is that of oxygen failure. With existing British equipment it is possible for a leak to exist undetected between oxygen regulator and mask, and in any event failure of the system may occur elsewhere. As is well known, the onset of anoxia is a very insidious thing, and needs to be continuously watched. [Although cabins are pressurized, the internal altitude when an aircraft is at, say 40,000ft will still only be of the order of 20-25,000ft, and oxygen will therefore be required continuously.—ED.]

High Speed.—Speed as such has no adverse effect on the human body, nor does it directly create any very great psychological problem. Speeds are becoming so high, however, that for certain tasks man's speed of thought is becoming inadequate. Interception of bombers at, say, 50,000ft by a fighter with a very high rate of climb is an obvious example, as is the brief time available for firing at the bomber when once it has been found.

Escape in Emergency.—The ejector seat has noticeably lightened the psychological load on the pilot in this field; but, even so, getting away from the seat and operating the parachute have not always proved easy, and cases have occurred of pilots ejecting and then making no obvious attempt to leave the seat, thus losing their lives. The introduction of the new fully-automatic seat, and the modification of existing ones, will therefore be a valuable contribution.

PSYCHOLOGICAL ASPECTS OF COMBAT FLYING

(*Summarized from a paper by Denis Williams, M.D., D.Sc., F.R.C.P., Civil Consultant in Neurology to the R.A.F.*)

FROM the physical point of view it is a relatively easy matter to pick a suitable aircrew member, but it is extremely difficult to estimate psychological make-up in the course of one or two short interviews. Sorting out those capable of accepting the risks of ordinary flying—who thus have a good chance to fly or otherwise perform well—is not too difficult, and the psychological tests that are so much in vogue do exhibit some success in rejecting potentially hopeless cases. When, however, it comes to selecting personnel who are so constituted psychologically that they can fly well and fight well at the same time, the difficulties really begin.

Statistics show that in World War II the omnipotent cause of neurosis caused by flying duties was fear; the task before the selectors, then, is to find personnel who have a high capacity to continue their task efficiently in spite of fear. No reliable method of selection has yet been found, and the best that has been devised is the rejection of the grossly unsuitable at intake, following by others on the advice of the flying instructor in the early stages of training. Psychiatric interview is useful only if the psychiatrist is first-class and if the men rejected can be as usefully employed in other less hazardous work.

Turning now to prevention of neurosis in those who are selected, it is found that the incidence varies greatly according to the duties involved. Percentage incidence during the last war was: night-bomber, 12; day-bomber, 11; day-fighter, 6; night-fighter, 4; coastal reconnaissance, 3½; and Training Command, 1.

The individual's response to the risks he meets can be modified by two means, and both these were employed in the last war. Firstly, systems such as that of being asked to carry out two tours only, with a rest between them, were successfully established, giving the man some chance of survival, some plan for the future. Secondly, every effort was made to strengthen morale. In this the part of the squadron and flight commanders was hard to over-estimate; wives, on the other hand, had an adverse effect. Morale is bolstered by success, by giving credit for success, and by making the credit known to the whole squadron. The immediate decoration, the impromptu party, and high-level praise—all have their part. It is lowered by blameworthy failure, by emphasis on difficulty, hazard and futility. A regular rhythm of living, whether of sleep, off-duty, leave, or games, needs close attention. The man must know of his obligations and his relaxations beforehand; he must not be kept in the dark, and, above all, he must not be frustrated by frequent change of plan or policy. Lastly, if fear must be endured, anticipation of that fear must be reduced to a minimum.

By these means, neuroses can be kept to a minimum. This is vital, because once a man has been removed from combat flying for neurotic reasons, experience has shown that the chances of returning him to it are negligible. Prevention is the best treatment.

HEALTH OF AIRLINE CREWS

(*Summarized from a paper by K. G. Bergin, M.A., M.D., D.P.H., A.F.R.Ae.S., Area Medical Superintendent, B.O.A.C.*)

THE medical supervision and care, in all its aspects, of the flying personnel of a civil airline presents many problems, which might not be apparent at first sight to those not fully acquainted with airline operations. The reason for this is that there is probably no class of person whose work is more closely bound up with, and influenced by, their physical, mental and psychological condition, and any impairment of function in these spheres is reflected in their flying efficiency, and consequently the safe and effective control of aircraft for which they are responsible.

After potential candidates have been tentatively accepted by

MEDICAL ASPECTS OF AVIATION . . .

the executive on the basis of their suitability on the grounds of flying ability, they are submitted to a comprehensive and detailed medical examination, including a family and personal history, the object of which is to ensure, firstly, that they are of a high standard of physical fitness on entry, and, secondly, that they are likely to remain so throughout their flying career. Following this examination the aircrew member is thereafter subject to periodic medical examinations, of the same thoroughness, at prearranged intervals of six months or a year, in order to ensure that the standard is being maintained or to note any gradual changes that might be taking place. In addition to these regular examinations, others are arranged at special times or after particular incidents, as considered necessary.

Apart from the actual physical fitness of the aircrew members, there are a number of environmental factors which are of great importance. Prominent amongst these is the design of the aircraft. The layout and equipment of the cockpit should conform with known physiological principles. Thus the seating should be anthropometrically designed; the lighting layout and design of the instruments be arranged for clear definition and give minimum eye-fatigue; the controls come easily to hand and be easily identifiable by the gloved hand—a most important point in an emergency; the ventilation, heating and humidity be confined within certain desirable limits; and the whole cockpit designed to minimize the fatigue of flying and assist in the efficient execution of flying duties. Such items as design of chairs, earphones, oxygen masks, microphones, life-jackets and sun-glasses all come within the province of the medical department, and can materially affect the maintenance of a high standard of health.

A most important item in aircraft is the proper insulation of fuselages against noise and vibration—both potent sources of fatigue—and the reduction of one or both these elements has had noticeably beneficial results.

Food, feeding and sleeping arrangements *en route* are extremely important and require careful watching and supervision by the medical department at all times. It has often been said, with truth, that flying fatigue occurs on the ground, and it is remarkable how great an improvement in general fitness can be achieved by attention to these matters. Accommodation must be so arranged that it achieves its main function, that of providing rest and refreshment satisfactorily. The sleeping quarters must be quiet, properly ventilated and protected against noxious insects; and the food must be of first quality, properly prepared and cooked, and cleanly served. There must be adequate recreational facilities, and the schedules must be so arranged that flying is interspaced with rest to produce safe and efficient operation over a long period.

Fatigue is a potentially dangerous state of affairs, because a fatigued pilot may make an error of judgment which may be fatal to himself and others. In addition to the more obvious factors contributing to this condition, such as excessive flying hours, bad weather or a difficult aircraft, there are many others, not so well known, which materially contribute towards the condition. They include delays and emergencies due to mechanical, weather, or other trouble, all of which can be very tiring to those responsible.

Finally, domestic problems play a not unimportant part in resistance to fatigue and health in flying personnel. A man who is worried over domestic, financial or marital affairs may not take adequate rest on his stand-down period, and, moreover, may be unable to sleep properly or concentrate when operating down the routes. Advice, sympathy, and assistance on such occasions can be a great benefit.

AIDS FOR HELICOPTERS

THE suitability of Decca as a navigational aid for rotorplanes is widely recognized, and many months ago B.E.A. expressed their intention of adopting it for their helicopter operations. As the employment of helicopters for commercial and military purposes continues to spread throughout the world the provision of reliable aids for all-weather operations becomes even more important.

It may be useful to recall here that the essential features of a helicopter aid are that it shall be accurate, easy to interpret, and—above all—shall operate down to ground level. The Decca system fulfils all these conditions. Its ability to work at low level at all ranges, regardless of terrain or buildings, is due to the employment of long-wave transmissions. The fact that Decca is an area-coverage rather than a beam system is a further advantage, since it lays down no restrictions whatever on the routes to be followed. Furthermore, no operator other than the pilot is required.

It was learned recently that the Decca Company is planning to incorporate a number of refinements, including an approach meter, which combines the information from the Navigator and altimeter to give a simple and accurate meter-displayed glide-path indication.

Another aid—for landing—which appears to have great possibilities for helicopter operation is a system recently devised in America by the Hastings Instrument Company, Inc., of Hampton, Virginia. Known as the Raydist blind-landing system, it is functionally almost the inverse of Decca. The aircraft carries a transmitter, whose signals are picked up by a pair of ground receivers (relay stations) which in turn feed a central master station, where an observer watches the plot of the aircraft position, and issues instructions to the pilot.

It will be recalled that the principle of the Decca system is that an airborne receiver measures (in effect) the difference in its distance from two ground transmitting stations. Lines of constant distance-difference form a family of hyperbolæ focused on the two stations, and the receiver indicates on which such line the aircraft lies. Another pair of stations (the Master is common to each pair) produces an intersecting pattern and enables the observer to fix his position.

To understand how this plotting works, it is first necessary to appreciate that a hyperbolic phase-pattern exists around the two relay stations by virtue of the time differences in their reception of the aircraft signals, and that two (or more) additional pairs of relay stations give the necessary intersections for fixing. The two position-lines are displayed, as in Decca, in terms of a numerical meter reading which identifies a numbered line on a chart; the "lanes," corresponding to 360-deg rotation of the fine meter-pointer, are less than one-tenth as wide as those of the Decca, with the result that sensitivity to aircraft movement is greatly enhanced, albeit at the expense of lane-identification.

The Raydist station layout includes a "reference" transmitting station on the ground, whose function is essentially that of synchronizing the operation of the relay stations so that the minute differences in transit-time (giving distance difference) of the signals from the aircraft may be accurately measured. This process has its counterpart in the "locking" of a Decca slave transmission with that received from the master. Raydist equipment can be deployed in a form giving the position information in the aircraft itself, and can also be used for the direct measurement of distance.

According to reports of a demonstration carried out recently with a helicopter in America, it was found possible to position the aircraft with an accuracy of less than a foot, so that the value of the system seems to lie particularly in its use as an approach and landing aid. For such an operation, the medium-wave transmissions are perfectly satisfactory for reception even down to ground level. At distances of tens of miles, however, in hilly country, interference would be very great; as a *navigational* aid, therefore, Decca seems the ideal answer, for it is accurate to within a few hundred feet at all ranges, and sometimes to a considerably smaller distance. Both systems are fully capable of night operation, although the performance of each is then reduced.

AVON COMET'S FAST CAIRO TRIP

BOUND for Khartoum, where it is now undergoing tropical trials, Comet G-ALYT flew non-stop from Hatfield to Cairo on May 5th in 4 hr 35 min. Although the flight was not observed by F.A.I. representatives and therefore cannot stand as a record, the time was 32 min less than that taken on the official record for the route (also by a Comet, in April, 1950). John Cunningham was the pilot on both occasions. This was the first overseas flight by G-ALYT, which is the Comet 2 "development aircraft," powered by four Rolls-Royce Avon 501s, and apart from the power units, is of Series 1 configuration. Production Comet 2s will have a longer fuselage—96ft compared with 93ft.

The Comet left Hatfield at 0545 hr G.M.T. and landed at Cairo International Airport at 1020 hr G.M.T. Its block speed, assuming a route distance of 2,182 statute miles, works out at 476 m.p.h. This speed, 48 m.p.h. faster than the official record, gives a useful measure of the extra performance conferred by the Avon turbojets. The main advantage in production Series 2s, however, will be the better payload-range performance stemming from improved thrust and specific consumption, and increased tankage (7,000 gal, compared with 6,000). With a 13,500 lb payload (44 passengers), the Series 2 will be able to handle stage-lengths of over 2,000 miles.

FAIREY GANNET

More than ever before Seaborne and Airborne elements are interdependent. The Royal Navy is constantly developing new weapons and new techniques to retain superiority. To attack with these new weapons and develop new methods of keeping the sea lanes clear the Fairey Gannet anti-submarine aircraft has been ordered for the Royal Navy. It has also been ordered for the Royal Australian Navy.

FAIREY AVIATION

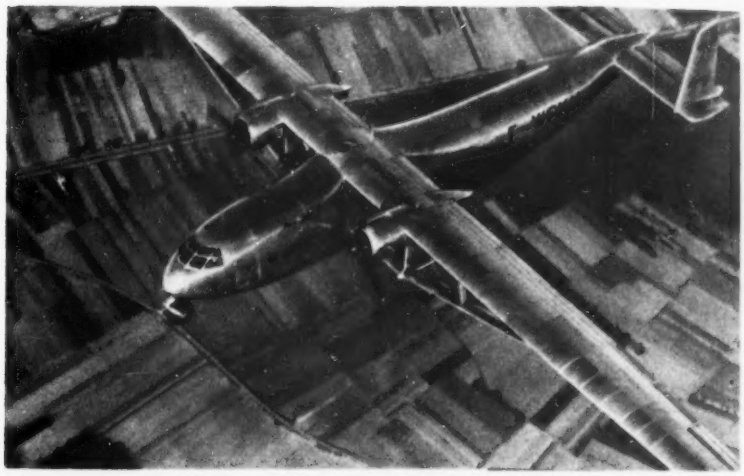
THE FAIREY AVIATION COMPANY LIMITED · HAYES · MIDDLESEX

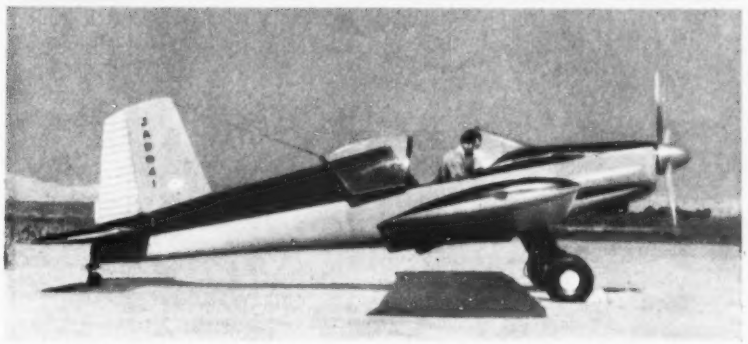
V E N O M
dual-purpose fighter
now entering the Royal Air Force in large numbers

Unsurpassed performance in bomber interception and ground attack, and providing full tactical flexibility.

D E H A V I L L A N D

AIRCRAFT INTELLIGENCE





BUILT FOR ECONOMY: The Hurel-Dubois HD-31 transport (top) is reported to be behaving well on its trials and to bear out its designer's confidence in its money-making ability. Seen in side view is the first Fletcher FD-25 Defender light ground-attack aircraft assembled by the Toyo Aircraft Manufacturing Company in Japan.

Great Britain

Modified D. H. Vampire. To assist the conversion of R.A.F. Transport Command ferry pilots on to Canadair-built North American Sabres, a de Havilland Vampire is being fitted in Canada with an American instrument panel. The Sabres, incidentally, are arriving in impressive quantities. They are camouflaged in Great Britain.

U.S.A.

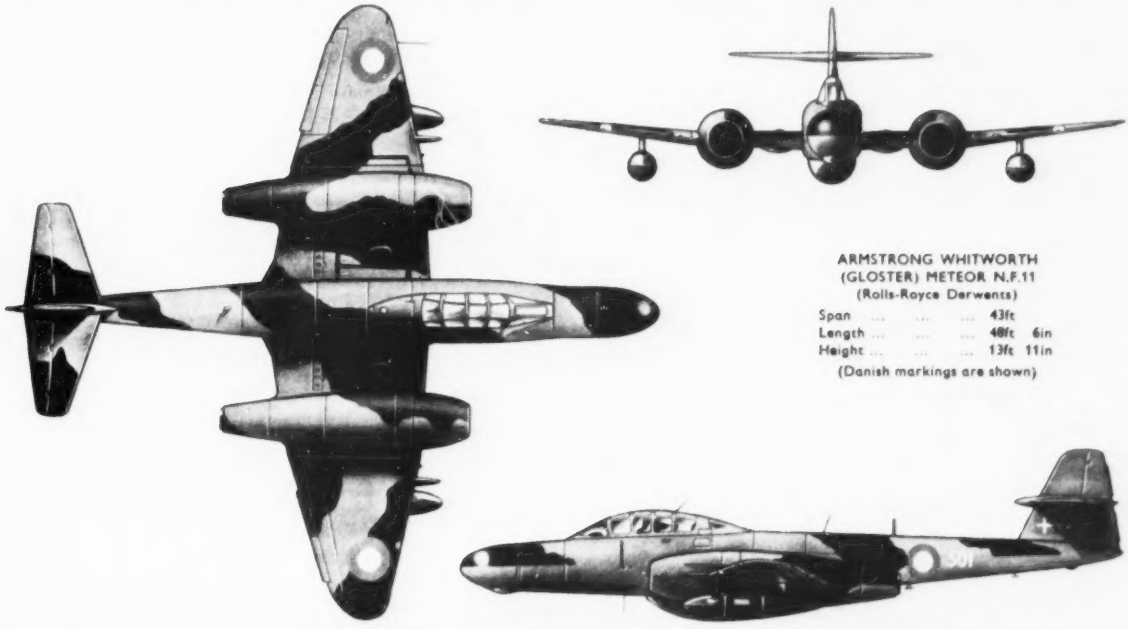
Republic Executive Aircraft. The executive aircraft *par excellence* is projected by Republic. It would sell for under a million dollars and would be powered either with Wright J65 (Armstrong Siddeley Sapphire) or General Electric J47 turbojets. Pressurized for operation at 45,000ft, it would carry 16 passengers.

New Fighters. Now under intensive development by Lockheed are a "light fighter" and at least one delta-wing aircraft. One of these types—both may be the same project—has been allotted the U.S.A.F. number F-104. At the Republic plant, work is progressing on the F-103 delta fighter and the F-105 fighter bomber, both of which owe something to the XF-91 Thundercepter. All these designs are for supersonic aircraft.

Grumman S2F-1. As yet unnamed, this twin-piston-engined search and strike aircraft is in full production at the Grumman Bethpage factory and may still be built at the Arlington factory of General Motors. The large search radar scanner will be housed in a "Guppy" radome under the forward fuselage. Folding wings and arrester hook are provided. Although not fitted to present production aircraft, boundary-layer control by means of porous suction wing panels was experimented with on the S2F; with full suction-power in use it was estimated that 600 gallons of additional fuel could be carried, so giving 75 per cent more range. But this report does not state where the suction power was to be obtained; in any case, it is unusual for a small twin-engined aircraft to show a gain in lift of nearly 5,000 lb by this method, which is more usually a means for reducing drag.

France

S.N.C.A.S.E. 210. France's promising jet airliner is the joint undertaking of the S.E. and S.O. groups, as mentioned by the presidents of both groups on page 280 of our March 6th issue. Now named Caravelle (a species of 16th-century sailing ship) the design resembles a Comet with a wing of higher aspect-ratio set well back towards the tail. Power is to come from two Atar or Avon turbojets mounted on short stalks on each side of the rear fuselage. The chosen window-shape appears to be a triangle with rounded corners, one side lying horizontally at the bottom. The wing of the prototype is being developed by the S.O. group; the fuselage is already being built by S.E. at Toulouse, where two prototypes will be assembled next year.



ARMSTRONG WHITWORTH
(GLOSTER) METEOR N.F.11
(Rolls-Royce Derwents)

Span	43ft
Length	48ft 6in
Height	13ft 11in

(Danish markings are shown)

VISITOR FROM FRANCE

The Bréguet 960 Vultur for Carrier Operation: Nene and Mamba Power

"FLIGHT" photographs

Cruising above strato-cumulus cloud, the Bréguet Vultur reveals a cleanness of line which is little marred by naval impedimenta.

IT is rare for a modern European military aircraft to visit this country; in fact, such machines are an unusual sight even over the Continent. One particularly interesting design is that pictured on these pages and, when an example came to England recently, we were glad to take the opportunity of paying it a visit.

The Bréguet Type 960 was developed from 1948 to a service contract. Its purpose was originally clear enough—to operate from carriers and to attack any ship or shore targets available. But several factors have complicated its rôle, while the aircraft itself is unique in many ways.

Bréguet's chief designer, M. Allain, is known to favour enterprising and novel solutions to problems and, since he considered gas-turbines a "must" for the aircraft, it soon became apparent that the design would be far from conventional. To achieve a high performance a turbojet was necessary. But Naval strike aircraft require long endurance, sometimes at low altitude, in conditions where such performance is rarely needed. The eventual layout specified a small, nose-mounted, turboprop and a large turbojet for use at take-off and during combat.

Not unnaturally, the Bréguet team soon turned to this country for proven power plants. Their choice fell upon the Armstrong Siddeley Mamba axial turboprop and—then going into licence-production by the Hispano-Suiza company in France—the Rolls-Royce Nene turbojet. Other British equipment was also chosen, among which may be mentioned the special Rotol four-blade airscrew and the Lucas fuel unit for the Nene, the latter being one of a number of items licence-produced by Air Equipement et Cie., of Paris.

The major proportion of the Type 960, however, is French through and through. The airframe is of straightforward all-metal stressed-skin construction, and it is evident that "quality, not quantity" has been the governing dictum. Like those of many French aircraft the skinning and general finish are first-class, and show an extremely high standard of workmanship. The skin gauge is not heavy, but the main structure is clearly very strong; the relevant French design-requirements are probably a mixture of those specified in this country and in the United States.

The tiny Mamba is quite lost in the Vultur's nose and is, in fact, surrounded by extraneous equipment. It is carried in a massive underframe, which also forms an anchorage for the nose undercarriage. Engine-air enters around the spinner and the exhaust issues from an orifice immediately beneath the leading-edge of the port wing-root. Beneath the spinner on the starboard side lies a fixed landing lamp.

The Hispano Nene is situated just behind the wing in a plenum chamber to which air is supplied from wing-root intakes—and also, when forward speed is low, from doors in the chamber itself. The plain jet-pipe is cooled by an induced airflow. Both Mamba and Nene run on kerosine to the French specification corresponding to DERD 2487.

The crew of two sit side by side in a large and comfortable cockpit. The mass of instrumentation appears to overflow into any suitable place and indicates the amount of equipment necessary in such an aircraft; a little of the space is taken up by prototype-testing gear. Martin-Baker ejection seats, built by S.N.C.A.S.O. are fitted, and the whole is covered by a vast hood assembly which includes a separate sliding roof over each seat.

The Bréguet-built undercarriage was impressive by reason of its wide track and long-travel oleo legs. The neat nose unit has twin wheels and is hydraulically steerable between wide limits. Dunlop (Paris) provide the tyres; the plate brakes are also Dunlop and, in the prototype we saw, are British-made.

The Bréguet 960 is "all-hydraulic." Equipment actuated by this means includes the undercarriage retraction and brakes, wing folding and rear-fuselage airbrakes. The little Mamba drives the various pumps and generators, since the Nene is out of use most of the time.

A typical offensive load consists of a single 1,000 kg weapon under the belly and eight rockets under the wings. There are no guns and there is no internal bomb-bay. Strike radar is carried in the starboard wing-tip "tank"; search radar, if required, takes the form of "*un grand Speedpak*" container under the fuselage. The container on the tip of the port wing is a genuine overload fuel tank.

As for the history of the type, it may be recorded that it has received the company-name of Vultur and the two prototypes so far built first flew in August, 1951, and September, 1952. "Vultur," incidentally, is anglicized; "Vautour" is a more usual French vulture, and this appellation has been conferred on a S.N.C.A.S.O. attack aircraft.

Both prototypes are fully equipped with naval gear and they differ chiefly in power plant; Type 960-01 has the variable-speed Mamba 1 while the later 960-02 is fitted with the more powerful Mamba 3, which is a constant-speed engine. The latter characteristic is particularly useful on carrier aircraft, and is a feature of the Gannet and Wyvern.

Vultur 01 carried out general handling tests in 1951 and, during

Banking away, the wing is seen to be of high aspect-ratio. Also prominent are the uncovered wheel-wells, the Mamba exhaust pipe and the arrester hook. The turboprop exhaust appears likely to cook whatever is hung from the fuselage rack.

high-speed runs, some tail flutter was noticed. Modifications to correct this trouble are evident in the present empennage. Test "ADDLs" or, as the French have it, *Appontages Simulés sur Piste*, and general perfection of naval techniques were done at Istres last spring; after initial flight trials had been carried out at Toulouse.

Vultur 02 carried out a lot of mass-balancing tests—as witness the elevator excrescences—and then flew to the Naval Flight of the R.A.E., Farnborough, at the end of January last. This was in order that catapulting and arresting trials should be undertaken, there being no French establishment with the required equipment. It is worth noting that, although Bréguet is not a part of the French nationalized industry, the request for the use of the Farnborough facilities came from the French Ministry of National Defence.

The Farnborough arresting procedure is as follows : the aircraft is aligned on the runway about half a mile behind the arrester wires and is run up to full power against the brakes; then the brakes are released and the machine accelerates towards the wires at full throttle; finally the hook is dropped and the throttles cut and the aircraft brought to rest, usually on the first wire. Full readings of weight, impact velocity and deceleration are recorded. This procedure is much quicker than actual circuits would be, and it is just as representative in proving the arresting gear on the aircraft.

The catapult trials involve standard carrier procedure. It should be noted that catapulting is today a different technique from that practised on capital ships and cruisers up to 1947. No longer does the catapult support the aircraft, which now rests on its normal undercarriage. The catapult—or accelerator as it was formerly called—actuates a bridle, the centre of which bears against hooks on the aircraft. The action of catapulting imposes a severe down-load on the undercarriage until the bridle is cast off.

The Vultur completed several accelerations—each the start of a full circuit—at normal all-up weight, without external stores Before such tests the position of the hooks was altered, at the suggestion of R.A.E. personnel. There is provision for R.A.T.O.G., but this has not been used. Other tests carried out in this country included specific fuel consumption readings while cruising on the Mamba.

The officer in charge of the aircraft on its English trip was Ingénieur Principal Perineau. Pilot during most of the work was M. Brunaud, chief test pilot of Bréguets, with Lt. de V. Picci acting as second pilot. M. Brunaud's chief concern of late has been the Provence (*Flight*, April 10th, 1953). Lt. de V. Picci is a C.E.V. test-pilot, nominated by Marignane; his *magnum opus* is the proving of the French-built Sea Venom—which work he finds enjoyable, for he likes the Sea Venom on every count.

On the ground, the wide track becomes apparent, as does the height of the cockpit, the latter necessitating lengthy ladders.

Taxying out, the Vultur rides easily in spite of its heavy underwing load. The Nene is kept at idling speed until the take-off run is commenced.

Visitor from France . . .

A Bréguet ground-crew of seven or eight has serviced the Vultur and they have been accommodated at a boarding house near the R.A.E. They clearly have great pride in their work and indulge in considerable operational smartness (of the kind defined by a well-known R.A.F. word) on their own initiative. In fact, the whole set-up, as we saw it, radiated efficiency and smartness. The two pilots, in brilliant blue flying suits and white Lombard helmets, went well with the gleaming Vultur, the general effect making a strange contrast with the ageing, hard-working Avenger placed at our photographer's disposal.

Starting up the Mamba appeared effortless and the airscrew was soon running smoothly, to the accompaniment of various cycle-indicating cockpit bells. The Nene followed and its roar completely drowned the noise of the tiny turboprop. Application of brake while taxying out made the Vultur nod gracefully, while the steerable nosewheels showed their worth in getting out of confined spaces.

Take-off was rapid and the wheels were up ten seconds from the start of the run. Again, the Mamba could only just be heard above the jet rumble; the overwhelming impression was that the airscrew was being pushed through the air by the Nene and was a hindrance to progress. Actually, the Rotol four-blader does its fair share under all conditions. It is constant-speeding even at 460 kt, at which speed the pitch angle is over 60 deg. In the air the Vultur has a suggestion of the F-84 Thunderjet about it, and the performance is undoubtedly high.

Approach is made at about 100 kt, and is very steep. Considerable change of attitude takes place during rounding out and holding off, and the major part of the run takes place with the nose high in the air. Unfortunately, in spite of M. Brunaud's fine handling, the copper rivets holding the underwing rockets proved unequal to their task during one landing; as a consequence, our air-to-air photographs show no external stores.

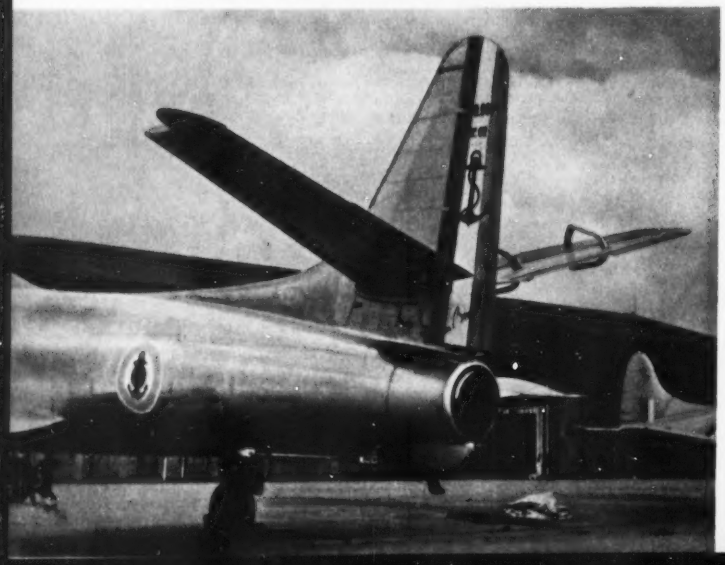
As for the future of the Vultur, much depends on the availability of American backing or NATO approval. The Bréguet plant at Toulouse is largely experimental and has little floor space; the Paris factory is full of huge Provences. It may also be noted that the Mamba has not gone into production, except in Double-Mamba form. In any case, France has no carrier able to take the Vultur's weight. A shore-based version is under development, however, and this should have almost fighter-like performance. Another modification is to be the fitting of a frameless canopy.

Whatever is to come of the Vultur, it is a most unusual design and makes an interesting contrast with the Wyvern (single-seat, single turboprop, fixed guns, no weapons bay or radar) and the Gannet (three-seat, double turboprop, no guns, large weapons bay, search and strike radar). It is to be hoped that this visit is the forerunner of others involving similar unconventional types.

BRÉGUET 960-02 VULTUR
(Armstrong Siddeley Mamba 3 and Hispano-Suiza Nene 104)

Span	54ft 3in
Length	43ft 4in
All-up weight	about 23,000 lb
Maximum speed	555 m.p.h. (482 kt)
Cruising speed (Mamba only)	230 m.p.h. (200 kt)
Landing speed	93 m.p.h. (81 kt)
Endurance (Mamba only)	4 hr
Absolute ceiling	42,000ft

From the aerodynamic aspect, almost the only feature marring the right-hand study is the elevator balance system. It is seen in closer detail below, together with the hook, tail-bumper and jet nozzle.



FACTS ABOUT THE GLOSTER JAVELIN / *Super Priority for the R.A.F.*

Point of Stall

High speed aircraft are often suspected of early stalling. The Delta Wing however, on the Gloster Javelin, enables this mighty fighter to land at low speed and its positive control characteristics to the point of stall are outstanding.

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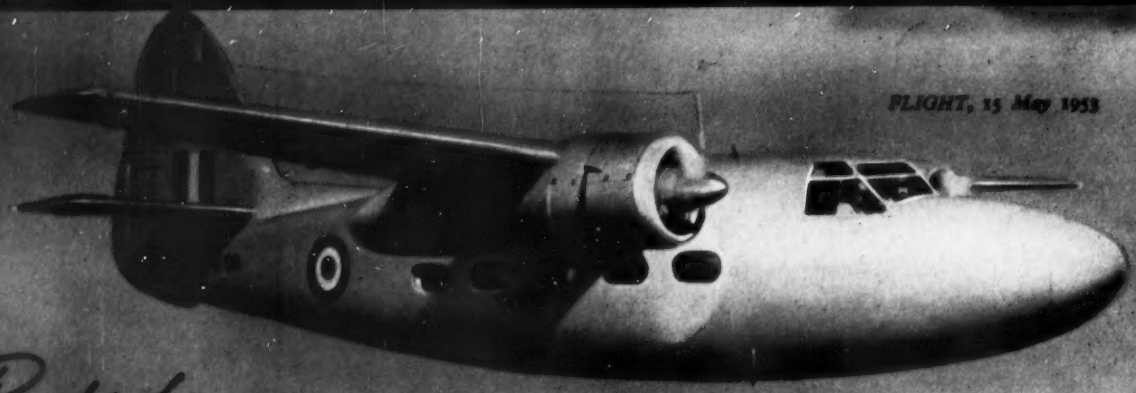

Pembroke

With 20 years' leadership in the design and manufacture of civil and military transport and training aircraft, PERCIVAL'S more recent developments—the PRINCE and the PROVOST—have achieved outstanding success in commercial and Service aviation.

The PROVOST, side-by-side two-seat Basic Trainer, fitted with the Alvis Leonides engine, is fully equipped for modern all-weather flying, and its performance and handling qualities are perfect for a trainer. Winner of competitive Service trials, the PROVOST is in large-scale production for the ROYAL AIR FORCE.

The PRINCE, powered again by "Leonides" engines, and in world-wide use as a civil transport, has also been adopted by the ROYAL NAVY, the ROYAL AIR FORCE and the ROYAL BELGIAN AIR FORCE. In Naval Aviation the SEA PRINCE is employed for communications and as a "flying classroom" for radar, radio and navigational training. The initial duties of the PEMBROKE—R.A.F. version of the PRINCE—include passenger transport, freighting, long-range ferrying, supply dropping and casualty evacuation.

For civil operation the PRINCE serves in many countries throughout the World for executive travel and with internal airlines, carrying 8 to 12 passengers. PRINCES have also been supplied to the British Ministry of Civil Aviation for radar and radio aids, calibration and testing. Its exceptional capacity, comfort and high performance meet the exacting demands of world-wide operating conditions, whilst versatility is exemplified by the SURVEY PRINCE, the only modern British aircraft developed especially for aerial photography mapping and land survey.

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Prentice

WHOSE PROBLEM?

The Future of Airfields: Serious Repercussions of V.R. School Closures

A RECENT letter from the Secretary of the Aerodrome Owners' Association which appeared in the *Daily Telegraph* has called attention to an important aspect of the problem resulting from the Air Ministry closure of the 14 Reserve Flying Schools. Although the unenviable position of the aircrew and ground staff concerned may be thought to be the obvious and primary cause for disquiet, consideration must most certainly be given to this other result — possibly slightly more delayed, but equally serious —the effect on the future of the airfields themselves. And their future does not appear a promising one.

The position was stated concisely by the A.O.A. Secretary, S/L A. W. Day, in his letter :—

"The schools which have already closed, and the others scheduled to follow, are all located at civil airfields, either privately or municipally owned, and they have been operating efficiently, economically, and to the complete satisfaction of the Air Ministry for many years.

"The revenue derived by their owners was just sufficient to keep these non-State-controlled airfields in being and in working order and in a position to grant facilities to flying clubs, the Air Training Corps and other aviation organizations of national value.

"We have only to cast our minds back to 1939 to appreciate the value of these ready-made airfields, all of which were requisitioned and played an immediate part in national defence.

"The present position is that unless the score or so of old-established airfields are used for some other purpose or given some form of aid, a number of them will be forced to close entirely. The land will be sold, hangars and ancillary buildings demolished or adapted for other purposes, and use of the airfields lost for ever.

"From a variety of angles closure of these well-kept and hitherto active airfields all over the country would be a national loss in peace and a tragedy in the event of war."

Information obtained by *Flight* has confirmed a Government reluctance to accept responsibility or to take action in this problem, in spite of the fact that the problem stems directly from Government action. Upon approaching the Ministry of Civil Aviation for discussion on the matter, the A.O.A. (together with the Association of Municipal Corporations) were referred to the Air Ministry. When the Secretary of State for Air did receive a joint deputation on this question, little of direct value resulted, as might have been expected from the fact that the Air Ministry's closure decision could obviously not be reversed (even if the A.O.A. had been wanting this—which they had not). The Association was clearly in touch with the wrong department : any remedial action would have to be the concern of the M.C.A.

It is to be hoped that the forthcoming talks between the M.C.A., the A.O.A. and the Association of Municipal Corporations will prove of more value. The problem affects municipal airfields especially, such as those at Rochester, Wolverhampton, Ansty and Derby, since they are financed by the local taxpayers and, without the Reserve Schools which contributed such a large part of their revenue, cannot possibly be run at an economic level at present. Barton Aerodrome, Manchester, has already been this forced to close down.

The flying clubs at the affected places will clearly find it impossible to carry on should the airfields be forced to close. The possibility of their sites being taken over for agricultural or building purposes is no happy one for the clubs, and yet they are obviously unable to do anything about this themselves, since they are, so to speak, in the hands of the owners—or the lap of the gods.

One class of club, however, is not protected by the action being taken by the A.O.A. on behalf of its private and municipal member-owners. For those clubs on Air Ministry airfields soon likely to close down through the reduction in V.R. activity, the position is even less secure. The only hope is that the Ministry will consider with understanding the future of such clubs when deciding which R.A.F. airfields are to be used no more.

Practicable suggestions concerning the use to which the apparently doomed airfields should be put are not easy to find. It is possible that training and other services could be performed for the State airline Corporations—one chief executive at least would not be unsympathetic to the problem—or that other Government or Service uses could be found for the now-redundant V.R. school buildings until the airfields can be in full use later on.

It is not a simple problem. But we feel that it could be better—and much better—handled were a little imagination shown by those whose responsibility it might not strictly be but who, if they desired, could do much. Constructive ideas concerning airfield development, reasonable appreciation and a helpful attitude from Government departments—all these are required if the striking of yet another hard blow to club, private and other small-scale flying is to be avoided.

THE AERONAUTICAL BOOKSHELF

"Escape or Die," by Paul Brickhill. Evans Brothers, Ltd., Montague House, Russell Square, London, W.C.1. Illustrated. Price 15s.

THE Royal Air Force Escaping Society was formed after the war as a means of reuniting R.A.F. prisoners-of-war who had made successful escapes from enemy camps, and of repaying some part of the debt owed to former civilian allies, especially the widows and orphans of those who died trying to help our airmen in France, Belgium, Holland, Italy and the Far East. This book—as that great escaper Air Marshal Sir Basil Embry explains in his foreword—has been written to provide much-needed funds for the Society's work.

It contains eight stories of escapes, and is illustrated with eight pairs of photographs, showing the central character of each story during the war and some years afterwards, back in the Service, on the stage, or at a desk in a bank. Each story is an epic of courage, initiative and sheer determination to survive, told in the superb style one would expect of the author of *The Dam Busters*, who has himself known the frustration, suffering and terror of life in a prison cage.

It is impossible to read this book without being intensely moved that men could endure so much just to be able to fight again; or that even the Japanese could devise such treatment for P.O.W.s as lashing them down, tightly spreadeagled, over young bamboo shoots, which grow five inches a day and "are sharp enough to be neither stopped nor diverted by the human body." Other impressions are the great usefulness of flying boats as rescue-vehicles in remote, undeveloped areas; how easy it is to make silly mistakes after escaping, such as riding a "borrowed" bicycle the wrong way round a Continental roundabout; the fact that some prisoners in Germany could plan escape three months ahead, whereas for prisoners of the Japanese it was often a question of immediate escape—or death; and the use by the Russians of Po-2 biplanes to supply surrounded troops and evacuate wounded on litters in underwing "mummy cases," as used today on helicopters.

"An Introduction to Statistical Calculations," by J. Mounsey. English Universities Press, Ltd., St. Paul's House, Warwick Square, London E.C.4. Price 15s.

AS an introduction to the subject this book might be a trifle abrupt to the complete layman, and insertion of a few paragraphs for explanation and definition would be welcome. But if the reader has a basic grounding in the subject, this work will enable him to cover a wide field without difficulty. It would be especially useful as a text-book to accompany an instructional course—but this would waste the many exercise examples. Presentation is clear, and the book is of a handy size.

OTHER BOOKS RECEIVED

Iron and Steel Directory. Louis Cassier Co., Ltd., Dorset House, Stamford Street, London, S.E.1. Price 25s.

Practical Stereoscopic Photography, by J. Moir Dalzell. The Technical Press, Ltd., Gloucester Road, Kingston Hill, Surrey. Price 18s 6d.

Aerodynamics of Propulsion, by D. Kuchemann and J. Weber. MacGraw-Hill Publishing Co., Ltd., London. Price 64s 6d.

Power Plants for Aircraft, by J. Liston. McGraw-Hill Publishing Co., Ltd., 95 Farringdon Street, London, E.C.4. Price 72s 6d.

Sailor Malan, by O. Walker. Cassell and Co., Ltd., 37-38 St. Andrew's Hill, London, E.C.4. Price 10s 6d.

"The Engineer" Buyers Guide. 1953, Morgan Bros. (Publishers) Ltd., 28 Essex Street, Strand, London, W.C.2. Price 5s.

Prelude to Space, by Arthur C. Clarke. Sidgwick and Jackson, Ltd., 44 Museum Street, London, S.E.1. Price 9s 6d.

A Selection of Tables for use in Calculations of Compressible Airflow. Prepared on behalf of the Aeronautical Research Council by the Compressible Flow Tables Panel. Oxford University Press, Amen House, Warwick Square, London, E.C.4. Price 40s.

AT THE B.I.F.

Some New Equipment and Technical Developments Worthy of Note

THE annual British Industries Fair, which concluded at Castle Bromwich, Birmingham, and Olympia and Earls Court, London, last Friday, again held a good deal that was of interest to the aircraft industry. Most of the exhibits, it is true, were applicable only in an indirect sense, for, in general, those firms which are S.B.A.C. members reserve their directly aeronautical products for exhibition at such shows as those of Farnborough and Paris.

Nevertheless, a visit to the vast buildings which annually house the engineering and allied sections at Castle Bromwich was productive of a good many points worth noting, and the review which follows is the result of such a tour. It does not claim to be a stand-to-stand report; the products of scores more firms could easily be specified did space permit, for very many companies—machine-tool manufacturers are a case in point—certainly make an important contribution to airframe and engine manufacture.

This year's theme on the **G.E.C.** stand was "the story of lighting," indoor and outdoor; and among special applications in the latter field, airport lighting was one chosen for illustration. Thus there was an ingenious diorama of an airport as seen from the cockpit of a landing aircraft, with a dimmer system to convert the scene from day to night, so that the complete array of vari-coloured pinpoints became apparent: approach-bar system, and runway, taxi-track, and obstruction lights; and there was even an identification beacon, flashing "G.E.C." in morse. Several of the full-scale fittings were also exhibited. They included both flush-fitting and elevated runway lights (the latter with a shear-notch just above ground level, to provide an obliging collapse should the light be struck by an aircraft) and a variety of red obstruction lights. Particularly interesting among the latter was a new four-lamp unit for tall factory chimneys and similar obstacles, designed to maintain itself in operation (the stand-by lamps are either switched-in automatically or from the ground) for long periods, so saving expensive steeplejacking.

Essex Aero, Ltd., Gravesend, showed a new development which should have some useful applications in aircraft construction, particularly for floors; shown as a sample was an extraordinarily robust and rigid "plank," some 7ft x 9in x 1in, fabricated from a shell of 24 s.w.g. light alloy sheet stiffened internally by small "witches' hat" thimbles pitched at 2in centres and Reduxed to the upper and lower skins. These assemblies can be made in panels of any area up to the sheet-size available, and in aluminium or magnesium alloy, or in steel.

At last year's Fair, **I.C.I. Metals** had an exhibit, mainly descriptive, dealing with the possibilities of titanium. This year there were several examples of the "new" material itself—including an ingot (weighing 300 lb and worth something like £1,200) and various examples of castings, drop forgings, brazed and spot-welded sheets, and an argon-arc-welded butt joint. The theme here was that titanium can be fabricated by any of the usual processes, and that welding is successful provided precautions are taken to avoid contamination by embrittling gases.

The next thing that caused us to halt was a sectional Derwent; it was on a stand advertising "Derby for Industry," **Rolls-Royce** and Derby, of course, being largely synonymous terms. Proceeding thence into the "hardware" section (the miles of stands are conveniently divided into hardware, building, electricity and engineering groups), we were arrested by the familiar name of **Short Brothers and Harland**—to find, to our considerable surprise, that the exhibit consisted entirely of very modern-looking carpet-sweepers, made by the firm's "Metoluk" division; the "Deep Sweeper," they call it—a description, one feels, which might be applied equally happily to submarine-seeking Sunderlands. Also in the hardware section were **Precision Metal Spinnings (Stratford-on-Avon), Ltd.**, who, though exhibiting what is known as "holloware" (saucepans, to our womenfolk), do quite a lot of aircraft spinnings in light alloy and steel: de Havilland, Percival, Short Bros., Westland and Alvis are, we were told, among their customers.

Webley and Scott, the famous Birmingham firearms manufacturers, confirmed *Flight's* view that the correct spelling of the famous signal device is "Very's pistol" (not "Verey," as so often written), and told us that the pistol originated even before the Kaiser's war—as a marine distress-signal, when it was only of 1in bore, against the 1½in usual in aviation today. **Aerofilms, Ltd.** (Boreham Wood, Herts)—"Industries from the air"—struck a topical note with a pilot's-eye view of the Coronation route, among the more familiar oblique and vertical industrial photographs; **Pritchett and Gold and E.P.S., Ltd.**, of London, advertised their Dagenite (Peto and Radford) aircraft battery "as fitted to the Comet"; **Herbert Terry and Sons, Ltd.**, the Redditch spring specialists, showed their "Anglepoise" lamps (as familiar over air navigators' desks as on office and factory tables), together with many examples of their springs and presswork; **Wolf Electric Tools, Ltd.** (London, W.5), had some splendid coloured sectional drawings of various of their portable tools—an idea to be commended for displays of this kind; the **Morgan Crucible Co., Ltd.** (London, S.W.11), had, among their many allied products, a show of "Reservoil" sintered-metal oil-retaining bushes; and **M.C.L. and Repetition, Ltd.** (Langley, Birmingham), showed how happy they are to "turn anything from the bar," no matter how odd its shape—all they ask, very reasonably, is a long enough production-run to justify the setting-up involved.

The B.B. Chemical Co., Ltd., of Leicester, had an ingenious display showing how various "Bostik" adhesives do their duty in adversity, test-joints being mounted under spring tension, in large flasks of deleterious liquids; one typical joint was of neoprene rubber to duralumin, united with "Boscoprene" adhesive 2413, and retaining its wedded state happily in surroundings of de-icing fluid.

Thompson Brothers (Bilston), Ltd., of refuelling-tanker fame, told us that among their current fabricated-steel products are flame-tubes and exhaust manifolds for several well-known aero-engine manufacturers, together with baffles, and so forth, for gas-turbine test-houses; from the **Airscrew Co. and Jicwood, Ltd.** (Weybridge), we learned that among their smaller fans now in production is a neat little centrifugal for circulating de-misting air to the Viscount's windows; and on the stand of **Jenolite, Ltd.** (London, W.C.2), we watched some most convincing demonstrations of various chemical preparations which include a rust-remover and rust-proofer, an aluminium keying solution (A.I.D. approved for aircraft finishes) and an aluminium degreaser and cleaner which imparts a smart exterior finish to the flying equipment of more than one well-known airline.

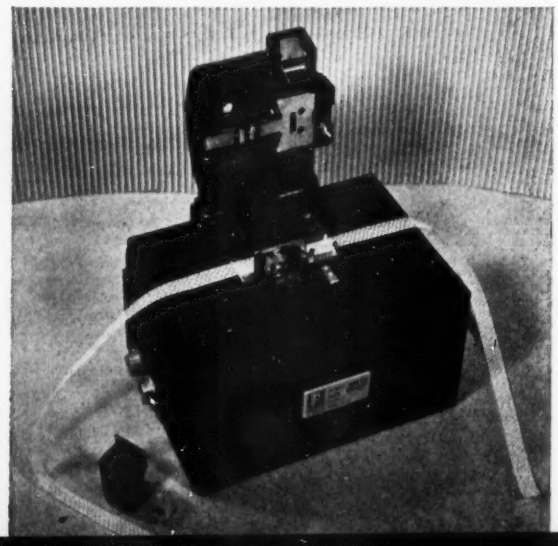
Among the endless variety of screws, bolts, nuts and so forth on the stand of **Guest Keen and Nettlefolds (Midlands), Ltd.**, there was to be seen the "Aerotight" stiffnut. This is a clever little affair, the upper portion of the nut being so divided by a vertical and two transverse cuts during manufacture that it forms two "wings," which are depressed at their trailing ends, so that the threads go out of pitch. The nut is then heat-treated, so that the two wings, now sprung, bear downwards with a friction grip on the flanks of the bolt-thread. Incidentally, Aerotight nuts are shortly to appear in the new Unified threads.

Among exhibitors whose names are household words in aviation were **Cellon, Ltd.** (Kingston-on-Thames) and, here again, we were impressed by the vast output of specialities—paints and finishes in this case, of course—for other fields of activity. Refusing to be diverted by the spectacle of a furniture panel being ill-treated with the milled edge of a half-crown (french polish, it seems, is fast retreating before the advance of synthetic materials), we pursued the aviation angle, to learn that a new finish, to D.T.D. 827 (provisional spec.) has been giving most satisfactory results in flight trials on some very fast aircraft indeed; resistance to ester-base lubricants is its *raison d'être*.

Autoset (Production), Ltd., of Birmingham 18, displayed their self-locating clamps for machine-tool worktables and, of course, the enormous range of castor-wheels for which they are famed: one particular variety, much favoured in the aircraft industry, is shod with a special laminated-canvas tyre; used to give mobility to assembly-jigs, it can be moved over a rivet-strewn floor which would do no good to rubber-tyred wheels or, if steel-tyred wheels were used, would result in damage to the floor itself. Many of these castors, incidentally, are provided with locks for the castor-spindle and for the wheel; others, again, provide jacking facilities.

The engineering components division of **Dunlop Special Products, Ltd.**, gave an illuminating illustration of the efficiency of their anti-vibration mountings (the display being achieved with the aid of a vibrating table and an oscilloscope), while the company's aviation division was represented by flexible piping as used in hydraulics; **Tufnol, Ltd.** (Birmingham, 22B), gave examples of the numerous applications of their versatile laminate, ranging from gear-pinions to jigs (one such latter, weighing 21 lb in Tufnol, would scale 1 cwt in steel); the **Saunders Valve Co., Ltd.** (Cymbran, Mon.), showed the industrial uses of variants of their valves that are so well known in aviation; **Goodyear** (Wolverhampton) had some refuelling hoses on view among their wide range of rubber products; **Chloride Batteries, Ltd.** (Swinton, Manchester), were featuring the use of Porvic separators in conjunction with the new antimonal lead plate-grid alloys; and **J. M. Steel and Co.,**

Ferranti, Ltd.—best known in aviation, perhaps, for their D.M.E. equipment—showed at Castle Bromwich a number of special-purpose instruments, including this high-speed reader—originally designed for use with electronic digital computors—of standard teleprinter five- or seven-hole teleprinter tape. It translates the pattern into electrical impulses.



Ltd. (London, W.C.2), were demonstrating the application of the "Glosscoat" plastic protective coatings and "Thermindex" temperature-indicating paints which we remarked upon at this time last year; "Plastopeel" cold-application strippable coating, for the protection of components, tools, etc., is a new development.

Aircraft instrument dials were to be seen among the examples of engraving, anodizing, fluorizing and luminizing work on the stand of **Glass Developments, Ltd.** (London, S.W.2), who are specialists in instrumentation and scientific apparatus; **Wright's Ropes, Ltd.** (Birmingham, 9), told us of some remarkable advances in the tensile strength of the aircraft cables and swaged fittings which are among their specialities—there is still considerable demand for such cables, even in these hydraulically-minded days; **Mavitta Drafting Machines, Ltd.** (Shirley, Birmingham), had on view the "Mavitta Master," their new endless-band type of machine, offering remarkable rigidity and precision in the operation of the scales; and **Hall and Hall, Ltd.** (Hampton, Middlesex), makers of "Hallite" aero jointing, showed us some rubber mouldings amenable to operation in extremes of temperature, quoting figures of minus 40 deg C to plus 90 deg C for one particular grade of hycar rubber.

We noticed that the Duke of Edinburgh, when he visited the Fair on April 30th, was particularly interested in the portable-tool demonstrations on the stand of **Desoutter Brothers, Ltd.** (London, N.W.9). Among the latest of these neat little tools—it first appeared at the S.B.A.C. Show last year—is a rivet-miller designed to assist in securing the smooth skins so necessary on modern aircraft, and to do its job without so much as a hair-scratch on the surface surrounding the rivet. We noted, too, some "standard press-tool" sets among the Desoutter exhibits.

In the past, the manufacture of miniature ball bearings for instrument and similar applications have largely been the perquisite of the Swiss, but on the stand of the **British Manufactured Bearings Co., Ltd.** (Crawley, Sussex), there were examples of English work in this field, one application shown being for an aircraft-instrument gyro; the smallest race displayed, utilizing eight balls, was of only 0.040in bore, 0.125in o.d. and 0.047in width.

On the stand of the Dohm Group of companies, who make a wide range of industrial ceramics, abrasives and other materials ("we can also pulverize, by very special arrangement, dangerous chemicals") was an exhibit by the **Renu Plating Co., Ltd.** (London, S.E.1), which included photo-anodized labels and dials for aircraft use. Also on this stand were some interesting examples of the high-vacuum process by which plastics and similar unlikely materials can be metal-coated.

The G.E.C. low-intensity taxi-track or runway light. The dome—which houses a 36-watt lamp—is designed to withstand the weight of an aircraft taxying over it.

Geo. Salter and Co., Ltd., the West Bromwich (Birmingham) spring specialists, quoted the Hunter and the Comet as being among aircraft on which their products are used (indeed, it would be difficult to find one on which they are not) and mentioned, incidentally, that they even make springs in Nimonic, for critical high-temperature applications; **Rozalex, Ltd.** (Manchester, 2), were demonstrating the value of their "barrier creams" as a defence against industrial dermatitis; **Jenson and Nicholson,** the Stratford (London, E.15) makers of protective and decorative finishes, were again exhibiting their "Liquid Envelope" peelable protective coating, now available in some additional varieties; **Air Maze, Ltd.,** of Warrington, showed us some remarkable fuel and oil filter components, including a phosphor-bronze wire screen of 325 mesh, rolled to such a smooth surface that it resembled a piece of glossy bronze-coloured paper; and **Clang, Ltd.** (London, N.W.2), were again showing small electrical parts, for which they are A.I.D. and A.R.B. approved.

Plastic Engineers, Ltd. (Treforest), were showing engineering components, including gears, moulded in nylon, and among the smaller fittings we noticed Simmonds Nyloc nuts, for which the firm supplies nylon insets; allied applications are in pressure-tight cap-nuts, (the cap being formed of nylon,) and in small valve seatings used in pressurizing systems. Moulded nylon, it seems, has some attractive characteristics —particularly in wear-resistance—for such components, and is resistent to oil and a number of other fluids.

English Steel Corporation, Ltd. (Sheffield), had, among the components on view, a Goblin turbine disc and a six-throw aero-engine crankshaft; **Smiths Industrial Instruments** (London, N.W.2) showed a wide range of instruments, many of which—including Desynns—were recognizable as first cousins, if not closer relatives, of their familiar aircraft equipment; and on the **Standard Telephones and Cables** (London, W.C.2) stand were to be seen some "Sentercel" trollies, larger editions of which are often employed for engine-starting duties on airfields: in situations where a.c. mains power is readily available on the tarmac, these handy units rectify the supply to d.c. at 28 V, with up to 2,000 amp short-duration current available for starting and 600 amp continuous for testing.

Bell's Asbestos and Engineering, Ltd. (Slough), now the core of a considerable industrial group, displayed photographs of their 'Bestobell" concertina hose in use on a Godfrey air-conditioning ground unit and on a "Nuway" (Nuway Heating Plants, Ltd., Droitwich) engine-heating unit; and among samples of their flexible heat-resistant connections were single-ring bellows similar to those used to form expansion joints between gas-turbine air intakes and leading-edge ducts.

Among the Conveyancer fork trucks exhibited was the new 6-20 (6,000 lb) model; it is seen here loading a K.L.M. Convair at Ringway.

Rubber Improvement, Ltd. (London, N.W.10), had natural and synthetic rubber mouldings on view, together with plastic (p.v.c.) sheeting for various purposes; and we learned that they have been supplying runway signs—parking marks, arrows, etc.—in p.v.c., designed for letting into the asphalt surface, the resultant indication proving satisfactorily resistant even to jet blast.

In aircraft manufacture, as in many other industries, it frequently happens that grinding, rotary filing, polishing and similar operations must be performed in situations where the tool has to be brought to the component rather than *vice versa*; the stand of **B. O. Morris, Ltd.** (Coventry) suggested that there could be few, if any, such problems which could not be solved by their "Morrisflex" flexible-shaft machines. **Vokes, Ltd.** (Guildford), showed only industrial equipment, but gave a hint of some important new aircraft filtration components now in production. "Immovable except by a spanner" was the theme of the small yet essential exhibits on the stand of **Philidas, Ltd.** (Ferrybridge, Yorks), whose self-locking nuts, A.I.D.-approved, have found many applications in aircraft work.

Acratork Engineering Co., Ltd. (Cardiff), were displaying the new airscrew hub-nut tightening device described recently in *Flight*; and added to their range of measurable-torque spanners was a new miniature model, the Acratork Minor, designed to deal with 0 to 4 B.A. sizes over a load-range of 0 to 36 lb/in.

Plus Gas Co., Ltd. (London, S.W.7), demonstrated their specialization in anti-corrosion compounds, mainly in two forms, a dismantling fluid (rust-remover) and a protective fluid for subsequent treatment of the work; a great many of the leading aircraft and engine manufacturers are among their customers for these materials.

The name of Dowty, which needs no introduction to people in aviation, was represented at Castle Bromwich by **Dowty Seals, Ltd.** (Ashchurch, Glos.), with a full range of their sealing rings and allied fittings in synthetic, natural and silicone rubbers. Particularly neat, we thought, was the "Strud," now much used in aircraft for integral fuel tank and similar applications: it is a leakproof bolt, essentially simple in that it consists merely of a recessed-head bolt, the 120 deg countersink of which has a rubber sealing-ring bonded to it. A range of rubber specifications is available to suit specific applications.

Though long established as makers of mobile electric generating plant, the firm of **Houchin, Ltd.** (London, E.14), was not previously known to us as makers of aircraft ground-starting equipment. On their stand, however, we noticed such a unit, and learned that the type is already being supplied in considerable numbers to the M.o.S. in response to a requirement for a unit suitable for starting F-86 Sabres. A D.C. generator driven by a Ford V-8 engine gives 600 amp at 28 V, with a 10 sec overload capacity of 1,400 amp; testing circuits for the aircraft equipment are also provided.

Industrial equipment intended partly or wholly for use out of doors is demonstrated in the open at Castle Bromwich, and among exhibits in this category we found the products of **Conveyancer Fork Trucks, Ltd.** (Warrington), a member of the Owen organization. Now added to their range of fork trucks is the Conveyancer 6-20, a 6,000-lb-capacity vehicle equipped, like others of their petrol and diesel models, with a fluid-transmission system that greatly simplifies driving. A photograph appears above.

Contractors' plant—including the vast and fearsome-looking machines sometimes seen at work of airfield construction—was also among the outdoor exhibits. As intriguing as the appearance of these devices is the names by which they are known: **Blaw Knox, Ltd.** (London, S.W.3), for example, could offer not only bulldozers, but angledozers, rippers, tamping rollers and weighbatchers. Perhaps it was as well that they did not offer us a sample to take home. . . .

CORRESPONDENCE

The Editor of "Flight" does not hold himself responsible for the views expressed by correspondents in these columns; the names and addresses of the writers, not necessarily for publication, must in all cases accompany letters.

Unification for Simplification

MAY I add a word or two about your invaluable editorial on the unification of simpler units? (*Flight*, April 24th).

There is nothing surprising about the distance from the pole to the equator being 10,000 km; it is the base of the metric system, simultaneously with the decimal circular measurement system. The base is taken as 100 grades (not degrees) in a right-angle and 0.01 grade of latitude is 1 km.

In principle, the kilometre is therefore as practical as the nautical mile, though I don't know whether the astronomical tables have been translated from degrees into grades. Also, a grade of longitude gives a change of time of 0.06 hr, which is also an exact amount of seconds (fundamental unit of time).

On a smaller scale, I always use grade tables whenever I am concerned with trigonometrical calculations, either natural or logarithmic.

On the other hand, I must agree that the 10-hr clock is a very arduous problem, though something towards solving it has already been put in practice for many years on the Continent. Many important firms are using the decimalization of the hour and save a lot of time in their comptability.

Rugby. R. E. R. PONCELET.

CONGRATULATIONS on raising the desirability of using the nautical mile, as expressed in your editorial of April 24th. May we hope to see all speeds and distances given as knots and nautical miles in aeronautical journals?

Perhaps this may influence the lay Press, who invariably quote aircraft speeds in m.p.h., despite the fact that the air-speed indicator is calibrated in knots. Why not give the *Queen Mary's* speed in m.p.h.?

London, N.W.2. L. F. E. COOMBS.

F.E. and B.A.T.

I WAS most interested to see the letters from Mr. G. W. Williamson (March 20th) and Mr. Stewart Brundell (April 3rd), arising respectively from my article on the F.E. series and from my letter about the B.A.T.

Mr. Williamson mentions a Martinsyde Elephant with a Rolls-Royce engine, and it seems that this may have been the Martinsyde R.G., a single-seat fighter which had the 190 h.p. Rolls-Royce Falcon. Span was 32ft, length 25ft 8in, maximum speed was 130 m.p.h. at s.l. at 2,375 lb a.u.w.; 10,000ft was reached in 10.3 min, and the service ceiling was 24,500ft.

This Martinsyde's designation and Mr. Williamson's notes lead to an interesting speculation. The Martinsyce single-seater with the Bearcmore engine was designated the G.100 when powered by the 120 h.p. Bearcmore, and the G.102 when fitted with the 160 h.p. version. Could the designation R.G. therefore stand for "Rolls-C"? The fuselage of the R.G. certainly bore a strong resemblance to that of the Elephant.

The little B.A.T. machine described by Mr. Brundell in his letter was the B.A.T. F.K.28 Crow, an ultra-light single-seater monoplane powered by a 40 h.p. A.B.C. Gnat horizontally-opposed twin-cylinder engine. It is illustrated on page 69a of *Jane's All the World's Aircraft*, 1920, and the accompanying data indicate that the span was 18ft, length 14ft, weight empty 265 lb, and estimated maximum speed 65 m.p.h. [We were able to publish a photograph in our Correspondence page last week.—Ed.]

The early designs of Frederick Koolhoven seem to be arousing some interest, and this is a good thing in view of the obscurity which surrounds them. I should be very glad to see them all listed. Koolhoven designed a number of Deperdussin machines before the war. Whether any F.K. type designations were ever allotted to them is doubtful, but it seems that the generally better-known F.K. type series started when "Kully" joined Armstrong Whitworths. Here are some of the type numbers known to me:—

F.K.1—This *may* have been the designation of the little Armstrong Whitworth single-seat scout biplane of 1914. It had a 50 h.p. Gnome engine. F.K.3—The well-known two-seater (the "Little Ack") built in quantity by A.W.s as their alternative to the B.E.2c. F.K.8—The two-seat corps reconnaissance bomber (the "Big Ack"); built in quantity by A.W.s and Angus Sanderson and Co., and used in France and Macedonia by the R.F.C. Standard engines were the 120 and 160 h.p. Beardmore; experimental installations of the 150 h.p. R.A.F. 4a and 150 h.p. Lorraine were made. F.K.9—An improved F.K.8, probably only a project. F.K.10—The Quadruplane two seater. At least three built by A.W.s and two more by the Phoenix Dynamo Manufacturing Co. F.K.11—A design for a fifteen-plane (!). Never built. F.K.12—The peculiar triplane with the Rolls-Royce Eagle and a small nacelle for a gunner on each middle plane. Serial number 7838. F.K.13—Reconnaissance biplane developed from F.K.8. Probably only a project. F.K.14—Project for a fighter. F.K.15, 16, 17—Designs for airship gondolas. F.K.18—Fighter, probably only a project. F.K.19—Light air-cooled engine. F.K.20—Ship biplane, probably a project. F.K.21—Trainer biplane, also probably no more than a project. F.K.22—The B.A.T. Bat. Designed to have the 120 h.p. A.B.C. Mosquito six-cylinder engine, and probably the 160 h.p. Gnome Monosoupape. F.K.23—The B.A.T. Bantam (170 h.p. A.B.C. Wasp I). Probably a dozen were built. F.K.24—The B.A.T. Baboon two-seat trainer (170 h.p. A.B.C. Wasp I). D.9731. F.K.25—The B.A.T. Basilisk single-seat fighter (320 h.p. A.B.C. Dragonfly). F.2906. F.K.26—The commercial post-war transport. F.K.27—Two-seat sports biplane (200 h.p. A.B.C. Wasp). F.K.28—The B.A.T. Crow (40 h.p. A.B.C. Gnat).

I do not know where the Armstrong Whitworth F.K.s stop and the B.A.T. F.K.s begin, but it seems certain that the A.W. series ran up to F.K.17 at least. The B.A.T. series obviously included the F.K.22, so it is Nos. F.K.18 to 21 which are in doubt.

I have seen a list which gives the designs F.K.1, 2, 4, 5, 6 and 7 as pre-war designs, but this results in an illogical sequence when read into the series I have described above.

Birmingham 32. J. M BRUCE.

Airline Operating Costs

OUR belief that examination of our annual reports will show our cost of operation per ton-mile to be as low as that of any passenger airline in the world appears to be borne out by the very interesting tabulation on page 285 of your issue of March 6th.

The all-in cost of each revenue short ton-mile of transportation performed by T.A.A. in the financial year 1951-52, expressed in sterling currency, was 33.5d. This is being achieved with Convair, DC-4 and DC-3 equipment. We hope it may be even lower when our fleet of Viscounts (due for delivery next year) goes into service.

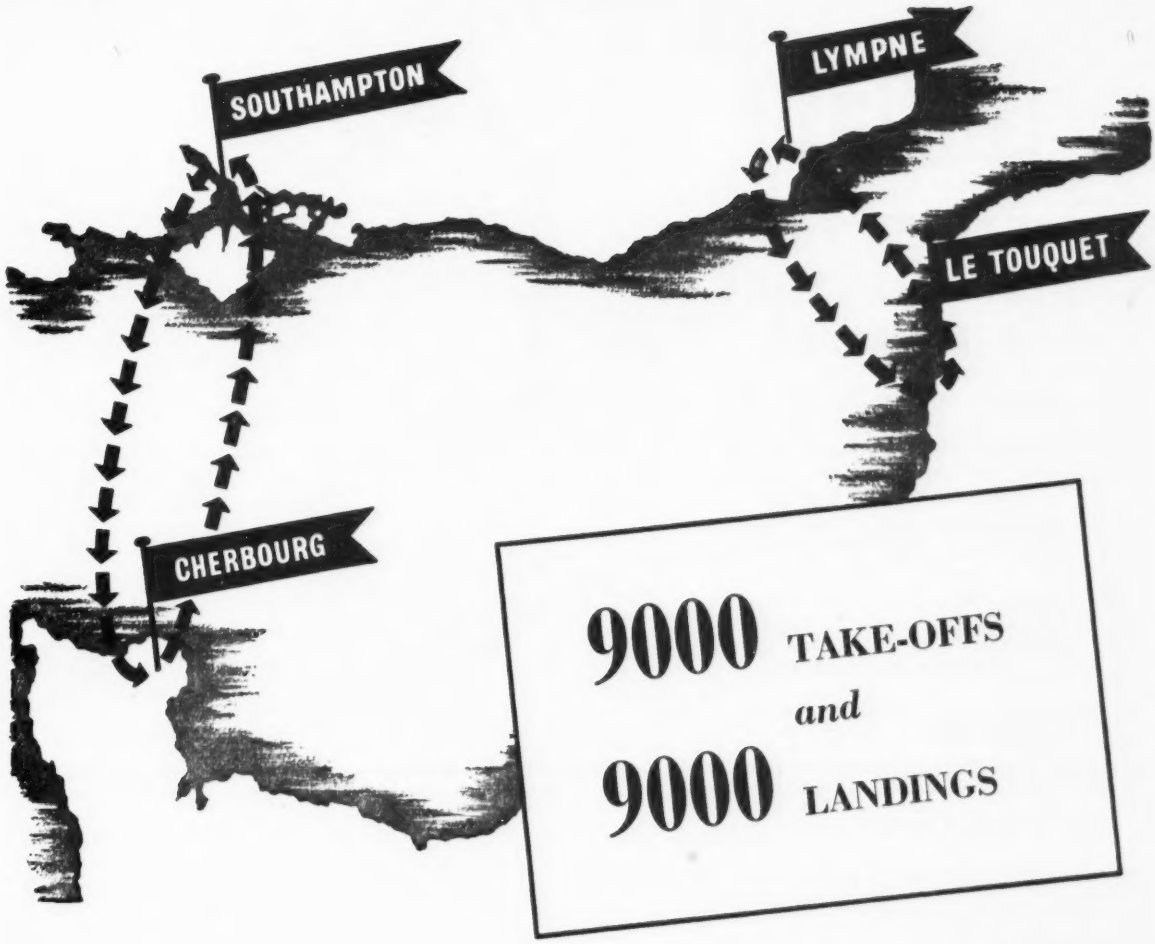
Low as it is, this figure does not enable us to charge fares at the level indicated in the first line of the tabulation to which I refer. The present first-class fare between Adelaide and Melbourne is £7 12s, in Australian currency, corresponding to £6 1s sterling, giving 3.6d per mile instead of the 2.7d shown in your table. The Adelaide-Sydney rate is approximately correct at 3.9d.

Against the hard fact that the lowest airline cost-level actually achieved is of the order of 33.5d per ton-mile, I am afraid we must be rather cautious in assessing the significance of Sir Roy Dobson's claim made on page 279 of the same issue. He states that another generation of commercial types is now ready for the airlines to order, with an operating cost of little more than ½d per passenger mile, or roughly 5d per ton-mile, at better than 600 m.p.h. I, for one, eagerly await specifications and a price quotation on this remarkable airliner, presumably derived from the magnificent Avro Vulcan. If an economic analysis based on guaranteed characteristics comes anywhere near Sir Roy's cost estimate, he will not have to wait long for orders.

Melbourne, Australia. J. L. WATKINS.
Director of Engineering,
Trans-Australia Airlines.

FORTHCOMING EVENTS

May	16.	Wolverhampton Aero Club: Goodyear Trophy Race and Display.
May	20.	Aircraft Recognition Society: "Supersonic Flight Problems," by Prof. A. A. Hall, M.A., F.R.Ae.S.
May	21.	R.Ae.S.: All-day Meeting on Aeronautical Acoustics (jointly with the Acoustics Group of the Physical Society).
May	23-25.	Aéro-Club d'Epernay: Champagne Rally.
May	23.	Derby Aero Club: Display.
May	25.	S.S.A.F.A.: Display, Yeadon.
May	25.	Air Display, Elmdon, Birmingham.
May	25.	Women's Junior Air Corps: Display, White Waltham.
May	26.	Aircraft Recognition Society (Plymouth): "Registrations and Serials," by R. S. Johns.
May	29.	R.Aux.A.F.: Officers' Coronation Ball, London.
May	30.	Auster Flying Club: Ragosine-Auster Homing Trophy.
May	30.	Swansea and District Flying Club: Display and Race.
June	5-7.	Yorkshire Aeroplane Club: International Rally.
June	6.	Leicestershire Aero Club: Coronation Air Display.
June	7.	Aero-Club d'Italia: Rome Grand Prix.
June	8-18.	British Plastics Exhibition and Convention, Olympia, London.
June	11.	R.Ae.S.: Ninth British Commonwealth and Empire Lecture, "Problems in Development of Air Transport in West Africa," by Sir Hubert Walker, C.B.E.
June	13.	"At Home," R.N. Air Station, Lee-on-Solent.
June	13-14.	Aero-Club d'Italia: Air Tour of Sicily.
June	13-14.	Rhodes Centenary Air Display and Rally, Salisbury, Rhodesia.
June	14.	Aéro-Club de Tangier: Tangiers Rally.
June	14.	R.Ae.S.: Garden Party, Hatfield.
June	15.	Coronation Naval Review.
June	16.	I.C.A.O.: Opening of Seventh Assembly, Brighton.
June	17.	Women's Engineering Society: Annual General Meeting.



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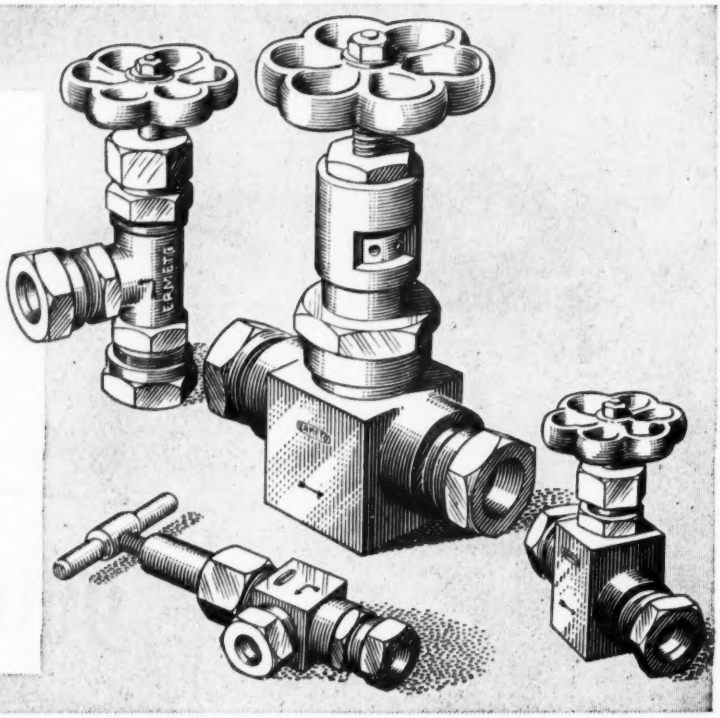

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VIEWS ON IGNITION

Wide Range of Subjects Discussed at the Third European Conference

AS briefly reported in a recent issue, the third European Ignition Conference, organized by Lodge Plugs, Ltd., was held in London on April 22nd and 23rd, under the chairmanship of A.Cdre. F. R. Banks, C.B., O.B.E., F.R.Ae.S., M.I.Mech.E., F.Inst.P. Over 120 delegates attended the conference, including technicians from a number of airlines, engine and accessory manufacturing firms, Government departments, Service units and fuel companies. The aim of the conference—a biennial event—is to bring together all those in the aircraft industry who are concerned with ignition and its many problems, to air these problems and discuss possible solutions, with the ultimate object of increasing the efficiency and safety of aircraft operation.

The opening paper, *Progress Report on T.C.P.* (tricresylphosphate), was given by Mr. S. A. W. Thompson (Shell Petroleum Company), and introduced the first main topic, that of sparking plug performance on present-day fuels. After operators' experience with T.C.P. had been described, the following questions were discussed. Had ignition troubles increased, or overhaul periods on plugs been reduced, with the increased lead content of the fuel? Were platinum plugs coming back into use because of the increased lead content, and did the oil companies intend to lower lead content of the fuel in the future? The experience of operators using American-type massive-electrode plugs, possible operational changes to reduce the lead-fouling effect, and the existence of a relationship between fuel/air ratio and plug fouling were the final points considered.

The servicing of aircraft plugs was the second item on the agenda, and an opening paper, *Chemical Cleaning of Aircraft Sparking Plugs*, was read by Mr. E. Harris of Lodge Plugs, Ltd. The process described was claimed to eliminate almost completely the wear and tear caused by most known methods, and the first production model of the Lodge cleaner employing this process was exhibited. Comment from operators and engine manufacturers with experience of chemical plug-cleaning followed, together with a description of general improvements in plug-testing. The need for a reliable and portable insulation tester capable of applying 15 kV to ignition circuits was considered, as was the value of the "hot leak" test, and possible elimination of plug servicing in favour of "one-life" operation.

The third aspect considered was that of service experience, in which points such as electrode wander, nose cracking, the conditions under which plug failures were encountered, and the possible change-over to ⅜in, 20 t.p.i. screen threads were raised. The ageing of plug ceramics and its detection, the uneconomic practice of effecting radical ignition changes on piston engines at present, the effect of engine and plug life on plug firing voltages, and improvements in electrode materials were also considered. The paper, *A Hypothesis on Pre-Ignition*, was given by Mr. R. Brinks, of K.L.M.

Ignition analysers formed the fourth main subject. Their use and advantages and the difficulties of training personnel were investigated, and also the extent to which analysers are in use with the airlines. An inquiry into their effectiveness in detecting loose magnetos and loose coil terminal-connections preceded accounts of their practical use on the Hercules engine.

Magnetos and harness were next discussed. It was thought that the removal of secondary condensers from American magnetos might have led to a decrease in ignition efficiency, and that the extension of the plug voltage on any given system might affect the performance of the magneto. A description of the advances in H.T. magneto design for longer operating life was followed by an account of operators' experience with magneto sealing, and mention was made of the use of silicone material for ignition cable insulation on both piston and turbine engines.

Recent Developments of High-Energy Ignition for Jet Engines was the title of the last paper, presented by Mr. H. E. West, of Rolls-Royce, as the first stage in the discussion of that subject. The criticisms that the standard British high-energy systems possessed too high a spark energy and too low a spark frequency were considered, and the degree of standardization of plug design obtained on turbines was defined. American experience with high-voltage medium-energy and high-energy medium-voltage igniters was studied, and interest expressed in the lightweight low-voltage low-energy high wattage capacity type of turbine ignition system.

The dinner which followed the close of the conference on the Thursday evening was, like the conference itself, held at the Savoy Hotel. In addition to the conference delegates, the guests included Sir Robert Renwick, Bt., K.B.E. (chairman), director, Lodge Plugs, Ltd.; G/C. C. S. Morice, D.S.O., M.C., sales director, Dunlop Rubber Co.; Mr. E. L. Bass, Shell Petroleum Co.; Mr. J. L. P. Brodie, director, de Havilland Engine Co.; Capt. K. J. G. Bartlett, director, Bristol Aeroplane Co.; Mr. R. E. Hardingham, O.B.E., of the A.R.B.; Mr. E. C. Bowyer, C.B.E.; director, S.B.A.C.; Mr. C. F. Abell (Bristol Aeroplane Co.); Mr. C. Abell (B.O.A.C.); and Mr. S. W. Hughes, director, H. M. Hobson, Ltd.

R.Ae.C. COMMITTEES, 1953-54

THE Royal Aero Club announces the constitution of its various committees for 1953-1954, as set out below; also given are names of stewards, timekeepers and other competition officials, together with those of the F.A.I. representatives.

THE COMMITTEE

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Vice-Presidents.—Capt. Sir Geoffrey de Havilland, C.B.E., A.F.C., Lord Gorell, C.B.E., M.C., Sir Francis K. McClean, A.F.C., Sir Frederick Handley-Page, C.B.E., Whitney W. Straight, C.B.E., M.C., D.F.C., The Duke of Sutherland, Kt., P.C.

Chairman.—S. Kenneth Davies, C.B.E.

Vice-Chairman.—Air Marshal Sir John N. Boothman, K.B.E., C.B., D.F.C., A.F.C.

Committee Members.—Capt. K. J. G. Bartlett, C.B.E., Air Marshal Sir Roderick Carr, K.B.E., C.B., D.F.C., A.F.C., G/C. W. N. Cumming, O.B.E., D.F.C., John Cunningham, D.S.O., O.B.E., D.F.C., Eric S. Greenwood, O.B.E., Rodney G. Kent, Capt. A. G. Lamplugh, C.B.E., Maj. R. H. Mayo, O.B.E., H. W. H. Moore, G/C. C. S. Morice, D.S.O., M.C., Maj. H. A. Petre, D.S.O., M.C., Maj. J. Stewart, O.B.E., Lawrence Swan, J. C. C. Taylor, M.B.E., C. F. Uwins, O.B.E., A.F.C., Frank Woodhead.

Other Committees

Finance.—Capt. K. J. G. Bartlett, C.B.E., G/C. W. N. Cumming, O.B.E., D.F.C., Eric S. Greenwood, O.B.E., Maj. R. H. Mayo, O.B.E., G/C. C. S. Morice, D.S.O., M.C., Maj. J. Stewart, O.B.E., C. F. Uwins, O.B.E., A.F.C., Frank Woodhead.

House.—G/C. W. N. Cumming, O.B.E., D.F.C., G/C. C. S. Morice, D.S.O., M.C., Maj. J. Stewart, O.B.E., Lawrence Swan, Capt. H. S. Broad, M.B.E., A.F.C., E. H. W. Lucas, P. B. Mayne, Capt. J. G. Renton, M.C., Maj. B. W. Shilson, O.B.E., Capt. R. H. Walmsley.

Records, Racing and Competitions.—Capt. H. S. Broad, M.B.E., A.F.C., E. C. Bowyer, C.B.E., John Cunningham, D.S.O., O.B.E., D.F.C., I. A. Forbes, Cdr. A. Goodfellow, Eric S. Greenwood, O.B.E., Capt. A. G. Lamplugh, C.B.E., D. J. Lyons, P. B. Mayne, Maj. R. H. Mayo, O.B.E., J. K. Quill, O.B.E., A.F.C., F. Rowarth, J. N. Somers, A.F.C., G/C. H. J. Wilson, C.B.E., A.F.C.

Private Flying and Air Touring.—J. G. Benson, C. E. Berens, W. H Byars, J. R. Cory, J. G. Crammond, E. S. Davis, A. D. Duncan, J. J. Dykes, J. C. Elwes, Rodney G. Kent, D. C. Maxwell, Maj. H. A. Petre, D.S.O., M.C., P. Q. Reiss, J. C. Rice, H. M. Samuelson, J. N. Somers, A.F.C., O. J. Tapper, J.C.C. Taylor, M.B.E., A. G. Wilson.

"Royal Aero Club Gazette."—Capt. K. J. G. Bartlett, C.B.E., Geoffrey Dorman, A. D. Duncan, E. H. W. Lucas.

Londonderry House Maintenance.—Miss N. Collins, G/C. C. S. Morice, D.S.O., M.C., Lawrence Swan.

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N.B. The chairman of the Club, Mr. S. Kenneth Davies, C.B.E., is an *ex-officio* member of all committees.

Stewards of the Club

Lord Brabazon of Tara, G.B.E., M.C., P.C., Air Marshal Sir Roderick Carr, K.B.E., C.B., D.F.C., A.F.C., Lord Gorell, C.B.E., M.C., Sir Francis K. McClean, A.F.C., H. W. H. Moore, Maj. H. A. Petre, D.S.O., M.C., The Duke of Sutherland, Kt., P.C., Frank Woodhead.

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SPECIALISTS IN SPARES

S/L. H. K. Hughes, D.F.C., founder of the Aerocontacts business. In this wartime snapshot he is seen alongside a No. 3 Sqn. Tempest.

THERE are, of course, very many companies that supply aircraft spares, but there can be few, if any, who have brought such intensive specialization to this branch of the industry as have Aerocontacts, Ltd., of Gatwick Airport, Surrey.

The firm is a comparatively young one. It was founded some five years ago by S/L. H. K. Hughes, D.F.C., who had served during the war with Nos. 79, 87 and 3 Squadrons and, apart from having shot down six enemy aircraft, had achieved something of a reputation as a "train-buster." But that is by the way; what is pertinent to the present story is that Hughes came out of the Service with an ambition to start and build up a business which, in particular, would be able to find and supply hard-to-get spares for pre-war aircraft still in, or resuming, civil use.

This aim, successfully achieved, presently led naturally to the stocking and distribution of equipment and spares for current-production types. Today, Aerocontacts have a staff of over 70 engaged solely in meeting demands both at home and abroad; requests come not only from charter operators and airlines, but from aircraft constructors and from purchasing commissions.

So great has this side of the business grown that within the past year the firm has formed a special division, under the name SCOBA ("Supplies Co-ordinating Organization for British Aviation") to deal with the work. "Co-ordinating" is the operative word, for the aim is to save manufacturers and operators the time and trouble of keeping track of sources of supply of the vast variety of equipment used in, or in connection with, all types and sizes of British aircraft.

In connection with the scheme—which is under the management of Mr. E. H. Newman—a records department has been built up in which thousands of items are listed and cross-referenced. Any one of them may be found and the source or sources of supply traced in a matter of minutes, irrespective of whether the enquiry gives the manufacturer's part number, the inter-service reference number, or the Air Ministry reference number.

Should the demanded spare in fact be virtually non-existent, then Aerocontacts proceed to give effect to the second half of that well-known slogan "The difficult we do instantly; the impossible takes a little longer." In other words, the records department is able to turn up the names of firms which, co-operating in the SCOBA scheme, can manufacture the item required. Not long ago, Aerocontacts tell us, a well-known firm of aircraft constructors needed a number of electrical adaptors of a type which became obsolete in 1941, and the original manufacturers of which had lost or destroyed the tools and drawings. SCOBA arranged to supply new drawings from which a member-firm could tool-up and make the components, and these were eventually supplied to the customers within three weeks of their making the original enquiry.

As another example of the "impossible," a private owner wanted to rebuild a pre-war Aeronca in, of all places, the Fiji Islands. He lacked two trifling components, in the form of wings. Aerocontacts managed to find them and ship them out to him.

The firm reports very willing co-operation from aircraft-component manufacturers, and in a number of cases plans are being made to market equipment under the SCOBA trade-mark as well as the manufacturer's own name. A market-research system studies future trends, to the ultimate mutual benefit of customer and supplier.

Lest it be thought that any and every item is sent out for, it should be added that Aerocontacts also maintain considerable stocks of radio equipment, electrical components, instruments and general aircraft spares for immediate delivery.

A separate section of the Aerocontacts organization is the aircraft division, managed by Mr. M. J. Spence. Apart from sales of new and used aircraft, British Commonwealth agencies are held for the S.N.C.A.S.O. Bretagne, for the Piaggio P. 136 amphibian and P. 148 trainer and (from S.N.C.A.S.O.) for the Turboméca Palas jet-boost unit. Recent aircraft sales have included Tiger Moths for the important New Zealand crop-dusting industry referred to in *Flight* of April 10th, and the company states that such machines, or engines or spares for them, have been sent on almost every ship sailing to New Zealand during the past two years.

Aerocontacts have agents, representatives or correspondents in the Scandinavian countries, the Benelux countries, Spain and Portugal, Iraq, the Middle East, South Africa, New Zealand, Australia, Thailand and India. Canadian sales are direct.

As regards aircraft servicing, arrangements have recently been made with the B.K.S. Engineering Co., Ltd., Southend Airport, whereby machines of up to 80,000 lb a.u.w. can receive anything from minor overhaul to major conversion. Certain airframe work, also, is done by Aerocontacts at Gatwick; here, too, the firm has a radio laboratory and electrical test-house equipped to undertake work to A.R.B. and A.I.D. requirements. Altogether, an enterprising concern that looks like going on to still bigger things.

BIRMAL'S FIFTY YEARS

SOME 250 friends of the Birmingham Aluminium Casting (1903) Co., Ltd.—a proportion of their customers and suppliers, with some members of Government departments—gathered in Birmingham on May 5th at a dinner to celebrate the company's fiftieth anniversary.

The concern actually had its origin in the latter years of the nineteenth century, when it began to use aluminium for certain bicycle parts. One of the founders of the business was Walter J. Maudslay—grandson of the great engineer Henry Maudslay, inventor of the screwcutting lathe—and he soon recognized the potentialities of this still comparatively "new" metal for the young motor industry; thus it was that his company began to specialize in aluminium castings and that in 1903 it was reconstituted under approximately its present title.

Since those days the story of Birmal—to give the firm its familiar short title—has been one of continued progress and expansion, in which the formation of the Birmid Industries group, shortly after World War I, was one of the principal milestones.

During World War II Birmal output was on a prodigious scale: aircraft castings alone were turned out at the rate of 1,000 tons a month, while a factory erected at Stourbridge produced a million magnesium incendiary bombs each month. It may be remembered that the late Mr. Percy Pritchard, the then joint managing director (who was asked to form the Castings Section of the Government's Light Alloy Control) introduced D.T.D. 424 (later known as L.M.4), thus making available, without royalty, one of the most versatile light alloys.

Today's Birmal products will be well known to readers in the industry. The latest specifications include "Birmidal," a general-purpose alloy, and a range of castings in the new magnesium-zirconium alloys under licence from F. A. Hughes and Co., Ltd.

Last week's jubilee celebration, under the chairmanship of Lord Burghley, K.C.M.G. (Birmal's chairman) was a most enjoyable function distinguished by some speeches of outstanding wit and polish: they were contributed by Mr. J. J. Gracie (G.E.C.) A.Cdre. W. Helmore, O.B.E. (director-general of the Aluminium Development Association), Mr. E. Player and Mr. J. W. Berry (Birmal joint managing directors), Mr. S. F. Burman, M.B.E. (managing director, Burman and Sons, Ltd.) and Mr. W. C. Puckey (Deputy Controller of Supplies, Aircraft, M.o.S.).

HIGH-PRESSURE HOSE

KNOWN for over 50 years as inventors and manufacturers of control-wire systems, Bowden (Engineers) Ltd., of Willesden Junction, London, N.W.10, claim also to be Britain's largest manufacturers of high-pressure hose. That this circumstance is not equally well known is due to the fact that, hitherto, they have not sold such hose directly to the user.

Now this side of their business is being separately developed, and coincident with the fact comes the introduction of an entirely new "Bowdenflex" high-pressure, high-temperature hose with quickly detachable end-fittings. A data-list shows that the range approved for aircraft use—a polysar-lined hose with flame-resistant neoprene outer cover, and suitable for most fuels and oils—comprises nine sizes: working pressures run from 1,500 to 3,000 lb/sq in for single-wire-braid hoses and from 3,000 to 5,000 lb/sq in for two-wire types. The hose can be supplied either with or without end fittings. "Bowdenflex" hose is being employed on a number of well-known gas turbines.

VICKERS VISCOUNT

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CIVIL AVIATION

I.A.T.A. DISCUSSES HELICOPTERS

AIRLINE operators, manufacturers and other interested authorities recently co-ordinated many of their thoughts on the prospect of commercial helicopters. The opportunity for a helicopter symposium—held at Puerto Rico on April 24th-26th—was provided by I.A.T.A. as part of the association's annual technical conference. Some 150 representatives took part in the discussions, whose object was defined by the chairman (Mr. J. T. Dyment, director of engineering for T.C.A.) as to provide "an educational exchange of information between the people who make helicopters, those who hope to use them and those who will have to regulate them"—but not to produce policy decisions.

The value of the discussions was, of course, greatly increased by the contributions of those pioneer operators which already have helicopter experience—B.E.A., Sabena, Los Angeles Airways, Helicopter Air Services (Chicago), Okanagan Airways, New York Airways and the Port of New York Authority. The length and scope of the discussions make it impossible to do justice to all the individuals whose views were put forward at Puerto Rico. A record of the symposium will be published in book form by I.A.T.A. later this year; meanwhile, we summarize the main trends of thought which were apparent during the talks.

Two famous designers set the stage for the discussion. Mr. Igor Sikorsky said that the helicopter—"the most universal vehicle yet created by man"—had a future which has barely been estimated by its most enthusiastic admirers. Mr. Frank Piasecki quoted some figures indicative of experience accumulated to date : 1,800 helicopters produced so far had, he said, flown about 2 million hours; 11 types were in production; 30 others were being flown experimentally; and 14 new prototypes were under development.

The Transport Role :—Most operators agreed with B.E.A. that the helicopter's most important rôle will be to fly between city centres on existing routes. Other uses foreseen were flights between cities not yet served by air, between airports and outlying towns, and taxi services. Manufacturers reported that various types of helicopter, with capacities for between 14-60 passengers and with cruising speeds ranging from 75-170 m.p.h., would be available within the next eight years. Two cost estimates were $200,000 for a 14-seater and $500,000 for a 36-seater. It was generally agreed that there were many ways in which civil operators could take advantage of military helicopter development, particularly where twin-engined types were concerned.

Route Characteristics :—Cruising between cities at at least 115-120 m.p.h., helicopters would fly maximum stage lengths of 200-250 miles. Rotorcraft might compete with cars and buses for distances below 30 miles, with trains between 30-175 miles and with fixed-wing aircraft over greater distances. The "commuter market"—the carriage of passengers between major cities and dormitory towns—offered the richest traffic and also that most full of headaches for the operator; the helicopter would be hard put to compete with special rate peak hour trains. Price competition might not be so important on other short distance routes, where passengers would pay more for the saving in time. About 80 per cent of the world's helicopter services would operate below 5,000ft (a good deal lower in many cases) but there would be a requirement for landing and take-off ability at greater heights.

ROTARIANS: Among those who spoke for operators and manufacturers at the I.A.T.A. helicopter symposium were (left to right) Capt. J. C. Kelly-Rogers (Aer Lingus), Lord Douglas of Kirtleside (B.E.A.) and Igor Sikorsky, pioneer of modern helicopter development.

Operations :—Typical engine cruise-ratings, expressed as percentages of take-off power, would be 50-55 per cent with piston engines and 65-70 per cent with turbines. Special filters might be necessary to preserve performance in view of lower operating heights. Reasonable instrumentation would always be necessary. Regarding A.T.C. problems there were strong views that it would be unwise to subject the helicopter to the same limitations as fixed-wing aircraft. During the years of development when traffic would not be heavy, a single helicopter operating in a given area could operate down to very low minima. In crowded zones, helicopters might be given exclusive use of the lowest height band, separate approach paths being provided for rotorcraft and fixed-wing aircraft.

No attempt was made to predict diversionary procedures, but it was pointed out that if weather prevented a city-centre landing, the nearest major airport could often prove an acceptable alternative. It was generally agreed that the I.C.A.O. 45 min fuel-reserve requirement did not apply to helicopters; as a basic principle it would be best to stipulate the factors determining the calculation of fuel reserves and to permit operators to judge the actual quantities according to circumstances. V.H.F. R/T. was likely to meet the requirement for static-free communications between the helicopter and the traffic service. A separate system might be necessary for company messages. Navigation lights as used by fixed-wing aircraft would not be satisfactory: it might be necessary to indicate the direction of movement of the helicopter and also to show pilots of other machines that it was a helicopter. European operators stressed the case for the use of the backward take-off during the next few years, and manufacturers suggested that angles of 45 deg for the approach and take-off would provide a proper safety margin without causing discomfort. Concerning rates of descent, it was felt that a fairly high rate would be acceptable over a short vertical distance—say 1,000ft. Pressurization would not be necessary, at least for the next six or seven years; the manufacturers' ability to build an almost air-tight cabin would minimize the effects of descent. Normal approach speeds might be 40-60 m.p.h., followed by flare-out to an almost stationary landing. Canadian operators spoke encouragingly of the rotorcraft's ability to withstand gusts and downdraughts, which seemed to be largely a question of power and rotor-solidity.

Forecasts of smoke in urban areas and more detailed forecasts of local weather were among the helicopter's meteorological requirements. On the subject of navaids (discussed in greater detail on page 604), operators stressed the need for light equipment with simple presentation of data (preferably a pictorial display), which could easily be read by a one-man crew. Existing approach aids did not overcome the helicopter problems at the present stage, and there was a need for a reliable self-monitoring aid which was easily used by a pilot and which needed no ground staff to operate it. The necessary visual aids would include lighting for identification and reference purposes and distinctive marking of the landing surfaces—such as the checker-board pattern used experimentally in the United Kingdom.

Quick servicing, fuelling and loading procedures might enable the turn-round times to be cut to 5-7 min for 14 seaters and 8-10 for 40-50 seaters. This was on the assumption that rotors would continue to turn and that there would be entrances and exits at both ends of the vehicle. Metropolitan operators emphasized the point of cutting down ground time and suggested that the loading problem would be eased by the provision of helicopters in which no possible disposition of load would put the c.g. outside acceptable limits. Two ways of quick weight calculation were suggested: integrated scales at the front and back entrances of the helicopter, and a turnstile which automatically registered weights. The advantage, from a parking viewpoint, of folding rotor-blades might be minimized by the cost-penalties of power-folding machinery or the maintenance of staff for manual folding.

Design Requirements :—Discussion of single-engined performance revealed considerable differences between operators and regulatory authorities, and manufacturers emphasized their own need for clear-cut specifications. American operators stated a wish for hovering ability up to and during critical part of the ascent (compared with the 200ft/min climb requirement stipulated by European operators), together with rate of descent which would ensure an undamaged machine. It should be possible to approach any suitable space at 50 m.p.h. and land at less than 25 m.p.h. in the event of total loss of power.

Much thought was given to the noise problem. One operator suggested that it might be necessary to compromise by devoting less weight to internal sound proofing and more to external mufflers, thus killing two birds with one stone. Dual instrument panels would be necessary, normally consisting of the following: vertical speed indicator, artificial horizon, rotor and engine-speed indicators, altimeter, directional aid and air-speed indicator.

Other aspects :—Delegates attempted to find an acceptable term for the helicopter landing site, choice being narrowed down to heliport and rotorstation. The majority preferred heliport, because it remains

(*Continued on page* 617)

CIVIL AVIATION . . .

NEW B.E.A. SERVICE

YESTERDAY (May 14th) B.E.A. were due to inaugurate the first direct service between London and Palma, capital of the Spanish island of Majorca. Operated by 27-seat Vikings, the service leaves Northolt at 11.40 a.m. on Thursdays and Sundays, makes a refuelling stop at Bordeaux and arrives at Palma at 5.50 p.m. Return flights are on Fridays and Mondays. Tourist fares are charged, a return ticket costing £39 3s.

OVER THE TOP TO TOKYO

ONE of the new DC-6Bs of S.A.S. will begin the airline's third Polar flight on May 23rd when it takes off from Oslo to fly *via* Thule, Anchorage and Shemya to Tokyo. The two previous flights were made in the eastbound direction, and were made for the dual purpose of delivery and proving (in preparation for the start of commercial flights, which awaits U.S. Government permission).

The Tokyo flight has been chartered by the Norwegian Ministry of Defence. Forty passengers—relief personnel for the Norwegian Field Hospital in Korea—will be carried.

PANAM IN '52

IN his annual report to stockholders, Mr. Juan Trippe, president of Pan American World Airways, announced that 28 per cent of all traffic—sea and air—between the United States and other countries is carried by the company's aircraft. He gave the following figures for results in 1952 (increases on 1951 figures shown in parentheses): 1,807,000,000 passenger miles (15); 1,426,000 passengers (11). The company's gross revenues amounted to $205m (over £73m)—a record figure. Mr. Trippe said that PanAm's Clippers have now completed some 40,000 Atlantic crossings, 24,000 trans-Pacific flights and 1,500 round the-world services, which he described as "a record of experience not matched in the industry."

VIKING WITHDRAWALS

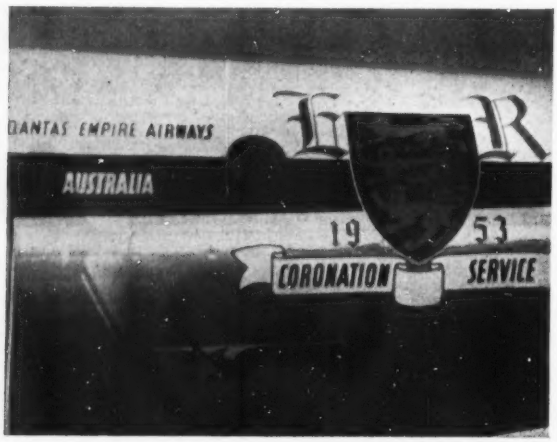
FOLLOWING the accident to a Central African Airways Viking in Tanganyika on March 29th, when fatigue caused failure of part of the aircraft's starboard main spar, several Vikings used by other companies have been withdrawn from service for inspection and, where necessary, modification. The flying times at which inspection takes place have been reduced to 6,000hr in Central Africa, 7-8,000 in India and Egypt and 9,000 in Europe. Investigation of the C.A.A. accident showed that the fatigue resistance of the component which failed had been weakened by corrosion, following the use of DTD 577 grease on unplated pins. Meanwhile, Central African Airways are reported to have been spending £8-15,000 daily on the hire of aircraft pending the resumption of services by a full fleet of Vikings. Other companies which have been affected—but to a lesser extent—are B.E.A., Misrair, Iraqi Airways and Air-India.

I.A.T.A. AND I.A.N.C.

NAVIGATORS of 29 of the world's major airlines are now permitted to attend appropriate I.C.A.O. meetings as official observers. This is announced by Mr. W. K. Henderson of Trans-Canada Airlines, vice-chairman of the International Airline Navigators Council, which was recently added to the list of organizations receiving such invitations.

Mr. Henderson stated that the move will greatly facilitate the work of the I.A.N.C.—set out as "the improvement of navigation techniques and promotion of safety in commercial aviation." In the four years since its organization the I.A.N.C. has grown consistently until it now represents 85 per cent of the world's active airline navigators.

The thirteen countries represented are Argentina, Australia, Belgium, Canada, France, India, the Philippines, S. Africa, Spain, Sweden, Switzerland, U.S.A. and the United Kingdom.



CORONATION SPECIAL: Throughout May the Constellations of Qantas Empire Airways will display this patriotic emblem at every airport on the "Kangaroo" route between London and Sydney.

PERSONALITIES—British and Japanese—concerned with the recent delivery to Tokyo and test-flying for C. of A. of a de Havilland Dove (see "Newspaper Dove" below). Left to right: H. Kanai, G. R. Todd, M. Takahashi, M. Tashiro, H. Iwabuchi, H. Ikeda, P. Nock, H. Cole. With the exception of Mr. Todd (D.H. field service engineer) and Messrs. Nock and Cole, those shown are inspectors of the Japanese C.A.B.

NEWSPAPER DOVE

AMONG the growing number of British aircraft used by Japanese operators are three de Havilland Doves, one of which (illustrated above) was recently delivered to the *Mainichi* newspaper at Tokyo. The aircraft was ferried from Chester to Tokyo in fourteen days *via* Bangkok and the Philippines by a freelance crew of British Aviation Services—P. Nock (pilot) and H. Cole (radio officer). Newspapers have always been among the most active operators of aircraft in Japan, and the *Mainichi* is no exception. It established an aviation section in 1924 and now operates four types of aircraft—Cessna 94, Piper Super Cub, Bell 47D-1 and Dove.

THE AMERICAN VIEW

A STRONG appeal for the development of civil turboprops in the United States was made recently by Mr. C. R. Smith, president of American Airlines. In a lecture entitled *The Turbine Engine and Air Transportation*, delivered at Syracuse University, Mr. Smith asserted that ". . . it seems to me to be the course of good judgment to defer adoption of the turbojet airplane until some time later. In the meantime, we should accelerate as rapidly as possible the development of turboprop engines of suitable size and power." His case against immediate adoption of turbojets by the American air-transport industry was summed up in the following sentences: "We are, all of us, still intrigued by the glamour of the turbojet airplane. But neither we nor you [the passenger] can now afford it."

The theme of Mr. Smith's paper was that all sections of America's airline industry should be freed from subsidy as quickly as possible. Already, he claimed, the principal domestic carriers were paying taxes in excess of their total mail income (his own airline had operated without subsidies for over ten years), and last year 93.6 per cent of the domestic mail had been carried at a non-subsidized rate. This trend would be accelerated if the airlines ensured that each new aircraft type adopted was capable of profitable operation.

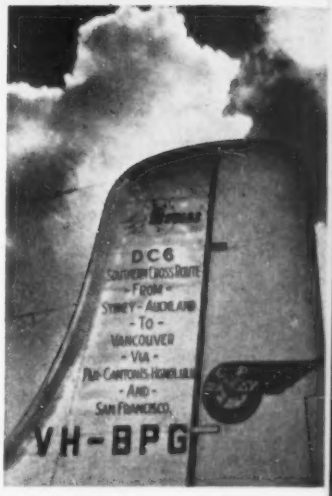
The paper also advocated ways of reducing the substantial elements of subsidy in two areas of U.S. airline operations: the domestic feeder networks and the overseas routes. Local carriers, Mr. Smith urged, should agree on a DC-3 replacement specification, and, if necessary, the Government should aid prototype construction. This investment would soon be repaid by reduction in subsidies. He believed that the national policy which required direct competition between U.S. overseas carriers was the greatest factor behind their need for subsidy, since the resultant degree of competition was often excessive and wasteful.

NEW SERVICES APPROVED

CONDITIONAL approval has been given by the Minister of Civil Aviation to the following applications for new scheduled services : Eagle Aviation Ltd.—Blackbushe-Sylt-Aalborg-Gothenborg-Helsinki, until July 31st, 1960; and Blackbushe-Cologne-Munich (all-freight service), until April 30th, 1960. B.E.A.—London-Bordeaux-Biarritz, until September 30th, 1959.

INTER-CITY HELICOPTER PLANS

BOOKINGS are now being accepted by Sabena for their first passenger-carrying helicopter service, which is due to open on September 1st. Seven-seat Sikorsky S-55s will be used on the Brussels-Antwerp-Rotterdam route, covering the 90 miles in 1 hr 10 min (including the stop), compared with about 2½ hr by train. The airline expects to have taken delivery of two helicopters by the early part of July, and on August 1st proving and mail-carrying flights will be inaugurated. Special stamps may be issued to commemorate the occasion—the beginning of international helicopter services. A special site for helicopters is being prepared on the Allée Verte, Brussels; the terminal for Antwerp will be the nearby airport of Deurne. It is planned to inaugurate another S-55 service—linking Brussels with Lille—at about the same time as that to Rotterdam, for which the Netherlands Government has already given approval.



EMBARK HERE FOR . . . All points on the B.C.P.A. trans-Pacific route are listed on the fin of the aircraft. Four DC-6s (to be replaced next year by Comet 2s) are used by B.C.P.A. on the "Southern Cross" service, which was inaugurated on April 25th, 1949; since then the company has achieved 260m passenger-miles of trouble-free flying, plus 2.8m ton-miles of mail and cargo.

BY HERON TO JERSEY

ON Sunday, May 10th, Jersey Airlines inaugurated a daily Heron service between Gatwick and Jersey, thus becoming the first independent airline to use the new de Havilland feederliner on a British domestic route. Registered G-AMYU, the aircraft is equipped as a 15-seater. At weekends it flies direct to Jersey, completing the trip in 1 hr 10 min, and on weekdays it flies *via* Alderney, leaving Gatwick at 12.35 p.m. and arriving at Jersey at 2 p.m. Rapides, which are still being used on additional services, take two hours for the 175-mile journey. The airline's recently opened London office reports very heavy bookings for the Channel Islands service.

BREVITIES

TEN airlines are now operating to and from Palmietfontein, Johannesburg : S.A.A., B.O.A.C., Sabena, K.L.M., El Al, S.A.S., Pan American, Qantas C.A.A. and D.E.T.A. Both U.A.T. and Swissair are negotiating for traffic rights.

* * *

International Aeradio, Ltd. announce the renewal for a further seven years of the agreement under which the company has provided flight-information and telecommunications facilities at Luqa, Malta, since 1947.

* * *

Following the conclusion of a bilateral agreement between the Philippines and Thailand, the Manila-London service of Philippine Airlines now calls twice weekly at Bangkok.

* * *

In order to demonstrate the value of air ferrying to Midlands motorists, the Automobile Association sponsored a return flight between Elmdon and Le Touquet on May 6th by a Super Freighter of Silver City Airways.

* * *

A former German army officer and two South African pilots are reported to have formed an airline at Johannesburg with five Skymasters and two Dakotas bought from an American company. The report adds that they have applied for a licence to run scheduled and non-scheduled services to Europe and to the United States.

* * *

Part of the prototype Britannia's cabin—the section just aft of the wing trailing-edge—is now being furnished and fitted with seats. Ballast tanks and special instrumentation will be retained for normal development testing, but the modified fuselage will enable a few privileged passengers to be carried in representative luxury, and the necessary data on cabin comfort to be gathered.

* * *

S.A.S. have moved their Scottish reservation and ticket office from Prestwick Airport to 164 Howard Street, Glasgow, C.1 (City 6718).

* * *

Having completed their work in 1952 "without a lost-time accident," Trans World Airlines have received a congratulatory letter from the National Safety Council of Chicago.

* * *

Naha, Okinawa, was the airfield illustrated on page 549 in our issue of May 1st; an official caption supplied with the photograph identified it as Manila, and this error was perpetuated in the reproduction.

* * *

Latest of "plush" airline services on the North Atlantic route is the *Royal Sabena*, operated three times weekly with 40-passenger DC-6Bs. Fully reclining seats are provided for 36 of the passengers, the remainder occupying berths in a small forward compartment. In 72-seat form, the recently acquired DC-6Bs also operate most of Sabena's six weekly transatlantic tourist services.

* * *

An Australian Civil Aviation Department order permitting airline pilots to fly 105 hr monthly is being contested by the Australian Air Pilots' Association, which has taken out a writ claiming that the proposal is contrary to regulations laid down in the Air Navigation Act. The Act is quoted as limiting the monthly hours of pilots to 100 "unless the Director of Civil Aviation is satisfied that longer hours can be worked with safety."

I.A.T.A. DISCUSSES HELICOPTERS (Continued from page 615)

the same in English and French. It was stressed that the dimensions of these sites and the characteristics of their approaches would constitute limitations to which manufacturers would have to build their machines. An American estimate of minimum space required was rotor diameter plus 50 per cent. European operators spoke in terms of 300 by 300ft maximum area (some of this space being available for parking), but U.S. metropolitan operators felt that areas 200ft square would normally be the maximum available. Plans were being made in New York for a heliport incorporating two such areas (one for take-off and the other for landing), the intervening space being devoted to administration and passenger handling. It was felt that under I.F. conditions there should be nothing to prevent take-offs at one-minute intervals, with loading and landing of other helicopters going on simultaneously. Concerning angle of clearance, European experience had indicated a requirement for one foot of clearance for every two feet from the edge of the take-off site, whereas U.S. opinion favoured more severe limitation—one in ten.

The advantages of rooftops versus ground sites were discussed at some length. Briefly, the main advantages of the rooftop heliport were the elimination of high ground costs, the reduction of the noise problem and the fact that they provided the pilot with ready-made altitude. Although operations from street level were now liable to be limited by turbulence under conditions of high wind, it was felt that this disadvantage would be nullified by the introduction of multi-engined helicopters. Methods of adapting existing rooftops for helicopter operations were also discussed : one specification for reinforcing a roof to withstand 4g vertical stress and 3g lateral stress was considered very generous by some operators. Three estimates for strengthening roofs were cited, the outlay as a percentage of overall cost being only 2 per cent in two instances and 10 per cent in the third.

It was universally agreed that rotorplane crews should have up to 1,000 hr of fixed-wing experience, but that when chosen they should keep solely to helicopter operations. Perhaps the most contentious question in the symposium was that of positioning the captain's seat; no final conclusion was reached.

Various suggestions for simplified ticketing, passenger handling and baggage procedures were put forward.

Discussion of the helicopter's economic prospects left the impression that initial operating costs will be high, that services might lose money for several years, but would eventually become profitable and that convenience (to the public) rather than cost-per-mile would often be the determining factor in setting fare levels. There might well be extra sources of revenue for passenger helicopters, such as sight-seeing. It was suggested that the optimum weight of a helicopter using gear transmission was between 20,000 to 60,000 lb. Initial, operating and insurance costs were all higher for helicopters than for fixed-wing types, although the latter charges should be lower when multi-engined helicopters were introduced, due to the decreased take-off and landing risks. Operators agreed on the desirability of exchanging insurance data. So far the rotorplane had a higher accident-rate but a lower death-rate per accident. On the subject of future governmental regulations affecting helicopter operations, manufacturers and operators alike urged that such requirements should be based on the characteristics of the rotorcraft itself and should not be arbitrarily carried over from the present regulations for fixed-wing aircraft.

DURESTOS GLIDER WING

Artist's impression of the M.76 design, which features the Durestos wing. The two-seat machine is developed from the aircraft which won the 1947 B.G.A. design contest.

ONE of the most interesting projects undertaken by the plastics division of F. G. Miles, Ltd., during the last three years, has been the construction for the British Gliding Association of an experimental wing—moulded in phenolic-impregnated asbestos material—for a high-performance glider. The machine, known as the M.76, is a development of Hugh Kendall's Crabpot I, which gained first place in the 1947 B.G.A. 2-seat design contest. Financial backing for the project has come from the Miles company, the Kemsley Flying Trust (through the medium of the B.G.A.), and the Ministry of Supply.

The effect of the chordwise position of boundary laver transition on a sailplane's performance is great, for laminar flow over an increased fraction of the chord gives a much reduced minimum drag coefficient. The achievement of laminar flow over as much as possible of the wing has been hampered in wings of normal construction by surface waviness, and it was felt that one way of obtaining the required improved finish would be to use some form of stabilized plastics construction.

It was decided to use a phenolic/asbestos fibre material stabilized with a paper honeycomb, the manufacturing technique being based on the vacuum moulding process pioneered by the R.A.E. at Farnborough. The 60-ft span wing was to be made in two semi-span sections each consisting of one 30-ft moulding—probably the largest one-piece moulded phenolic/asbestos structures yet manufactured.

The method of construction is, briefly, as follows :—

(1) A model of the wing, with exactly the same shape as the wing itself, is made from concrete, steel and a phenolic/asbestos material.

(2) A layer of soft phenolic/asbestos material is placed upon this model and made rigid by heat cure. This is called the master liner.

(3) A further layer of phenolic/asbestos material is then placed on this and heating mats and thermocouples are put in place and again heat cured. The shell produced is the heart of the main mould.

(4) This mould is then supported in place and covered with concrete.

(5) To make a wing, the soft Durestos felts are cut to shape and placed in position on the loading table, together with the paper honeycomb (Dufaylite) filling. The outer felts are then laid in place, and the table is lowered over a loading trolley.

(6) The loading trolley and soft felts are then moved into the mould. A rubber bag is used to seal the felts and apply suction.

(7) Electrical heaters driven by a 112 kVA generator are used to cure the product, and after about six hours the complete stabilized wing skin is cured.

(8) The wing is then removed from the mould and after trimming is ready for the fitting of ribs and trailing edge closing member.

The steel root fittings are moulded into the wing *in situ* at the time of cure.

In developing this method of construction, the company has had to face a number of original problems resulting from the use of the new materials. Mould cracking due to temperature variations in the concrete mass and to pinching action of the cured phenolic/asbestos mould surface, and the inconsistency in quality and effect of certain apparently identical mixes of resin, were among the setbacks experienced. A really close liaison between design staff and the operatives has proved invaluable for the successful introduction of the new techniques.

The date when the M.76 will fly is still some time ahead for, up to the present, only starboard wings have been produced, and the glass fibre ribs and trailing edge member, and the ailerons, have not yet been fitted. R.A.E. tests are about to commence, and the first public view of one of the moulded wings will be at the British Plastics Exhibition.

The main value of the Miles project is clearly wider than that of the particular wing; it lies in the "know-how" of the techniques of this method of moulding. For the future, further applications are inevitable—and a number are already being considered.

The possession of a two-seat machine such as the M.76 would obviously be a good thing for Britain in the 1954 world championships. To guard against delays in the production of the plastic wing, a wooden wing to the same specification is being constructed by Elliotts of Newbury, and is to be fitted to the conventional wooden fuselage built by Miles.

CLUB AND GLIDING NEWS

THERE are 20 entries for the Wolverhampton Aero Club's Goodyear Trophy Race, to be held at the Municipal Airport, Wolverhampton, tomorrow (Saturday, May 16th). The pilots and their aircraft are as follows (the pilots are also the entrants, unless otherwise stated):—

Miss L. E. Curtis (Wicko, Gipsy Major 1), R. R. Paine (Miles Hawk Speed Six, Gipsy Six 1F), D. J. Bennett (Proctor 5, Gipsy Queen 3), H. J. G. Turner (Proctor 3, Gipsy Queen 2), F. Dunkerley (entrant, D. J. Adie, Miles M.28-6, Cirrus Major 3), G/C. C. M. M. Grece (Miles Nighthawk M.7, Gipsy Six 2), D. F. Ogilvy (Moth Minor, Gipsy Major 1), J. N. Somers (Mew Gull, Gipsy Six 2), D. J. Jemmett (Miles Hawk Trainer 3, Gipsy Major 1C), W. P. Bowles (Messenger 2A, Cirrus Major 3), G. G. Alington (Tipsy Junior J3, W. Mikron 2), J. P. Growther (Proctor 3, Gipsy Queen 2), P. Fillingham (Chipmunk 2, Gipsy Major 4), G. R. I. Parker (entrant, R. Blackburn, Proctor 5, Gipsy Queen 2), H. C. Willson (Messenger 2A, Cirrus Major 3), P. Hillwood (Proctor 1, Gipsy Queen 2), S/L. J. Rush (Falcon Six, Gipsy Six), A. J. Spiller (Leopard Moth, Gipsy Major 10), A. S. L. Paine (Proctor 1, Gipsy Queen), G. C. Marler (Falcon M.E.B., Gipsy Six.

The race begins at 3 p.m., and will be preceded at 2 p.m. by a flying display, with Service support; the French Stampe squadron will also take part. Visiting aircraft must arrive by 1.30 p.m., and a buffet lunch will be available for their crews. Admission for the public is at 2s 6d (children, 1s 6d).

JUNE 20th is the date scheduled for the 1953 National Air Races, to be held at the Municipal Airport, Southend-on-Sea. The programme includes the Grosvenor Challenge Cup, the Norton-Griffiths Challenge Trophy, the Kemsley Challenge Trophy and the King's Cup races (see p. 597 for entries) and also a display.

CLUBS' flying-time totals for April include Denham Flying Club, 153 hr; Elstree Flying Club, 200 hr; Fairoaks Aero Club, 241 hr; Strathtay Aero Club, 177 hr; and the Yorkshire Aeroplane Club, 181 hr.

THE fifth International Air Rally of the Yorkshire Club will be held from June 5th-7th, and will be centred at Harrogate. Guests from nine countries have already accepted invitations, and a full programme has been arranged.

THE opportunity to learn to fly at no personal expense is offered by the Elstree Club to the fortunate person who fills their present clerk/typist vacancy. C.F.I.-cum-manager David Ogilvy is looking for an aeroplane enthusiast who doesn't object to "the odd hours so essential with a flying club."

A TECHNICAL description, performance data and three-view plans of the Dart Kitten are contained in the April issue of the *Popular Flying Association Bulletin*. Similar treatment of the J.A.P. J.99 engine (which powers the Kitten) this month is to be followed by a series describing other ultra-light aircraft and engines. P.F.A. announces tbat the Wycombe Flying Group are planning reorganization, with the intention of purchasing their own aircraft.

FROM Lasham comes news of an 88-mile cross-country by *Daisy* (Surrey and I.C. Club's well-known T.21B) during April, from the home aerodrome to Cambridge—via London Airport. A recent arrival is the T-31, which has now been named *Pansy*. The Army Club's Tiger Moth is now available for aerotows during a six-month season—at 15s for 2,000ft.

THE STRESS IS ON THE FINEST MATERIALS

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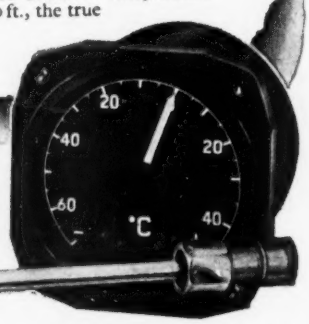
From the article "Operating the Comet" by D. O. MacDougall in the May issue of Shell Aviation News.



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SERVICE AVIATION

Royal Air Force and Naval Aviation News

Palace Presentation

TOMORROW, Her Majesty the Queen is to present a Squadron Standard to No. 600 (City of London) Squadron R.Aux.A.F. at Buckingham Palace. This is the first of the Squadron Standards to be presented to a unit of the Royal Auxiliary Air Force.

The Queen Mother is the Honorary Air Commodore of No. 600 Squadron and it is commanded by S/L. J. P. Meadows, D.F.C.

Pathfinders Dine

THE annual dinner of the Pathfinder Association once again proved to be a special occasion this year, for among the guests were the Chief of the Air Staff, the High Commissioner for Australia and Marshal of the Royal Air Force Sir Arthur Harris, Bt., G.C.B., O.B.E., A.F.C. The dinner took place at the Dorchester Hotel, London, on May 7th, with the president, Dr. J. C. MacGown, D.F.C., in the chair.

Proposing "The Royal Air Force," His Excellency the Hon. Sir Thomas White, K.B.E., D.F.C., V.D., remarked that we had no victory until we had achieved mastery of air power. It was never easy in the Air Force, however interesting. It was his opinion that Britain was still supreme in its aircraft, and Australia was following in our tradition. Australian Sabres would have Avons. He recalled that during the war Australia lost nearly 5,000 aircrew men flying from Great Britain.

The Chief of the Air Staff, Air Chief Marshal Sir William F. Dickson, G.C.B., K.B.E., D.S.O., A.F.C., replying, said that it was a great honour that "Tommy" White, Cabinet Minister, author, poet and pioneer pilot, should propose the toast of the R.A.F. He recalled that he had been the first Australian pilot to go into active service, had served in two wars, and had been the hero of a most thrilling and enterprising escape which was the embodiment of the Pathfinder spirit. Australians were handsomely represented in the *corps d'élite* which was the P.F.F. The C.A.S. then extended a warm welcome to "Bert Harris," the master bomber himself, who was present, and to the late C-in-C. Bomber Command, Sir Hugh Lloyd. Referring to Bomber Command, Sir William said enormous sums were being spent to get electronic equipment ready: Bomber Command had an enormous national and democratic rôle to play, he added.

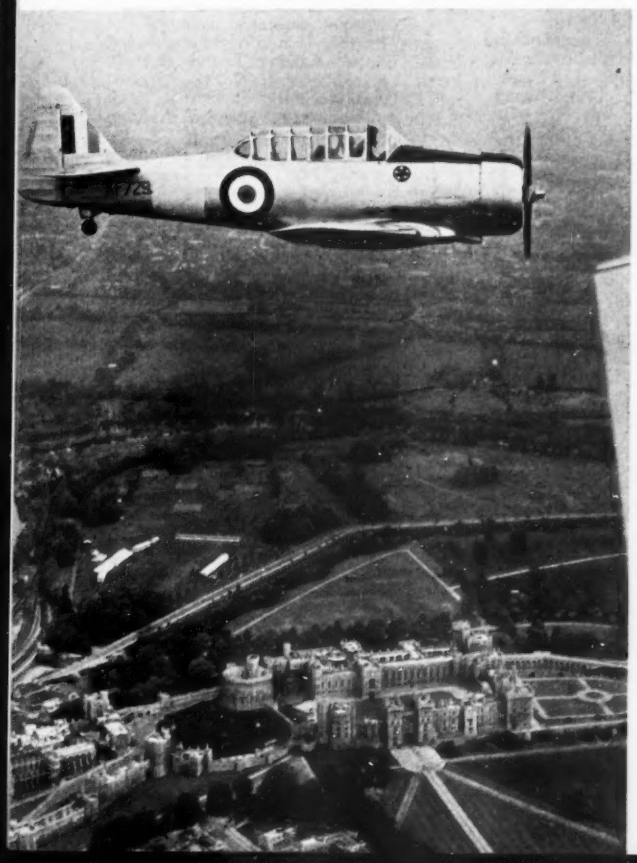
"Bomber Command" was proposed by W/C. T. G. Mahaddie, D.S.O., D.F.C., A.F.C. He claimed in introduction—and hoped historians would note—that he was "the only chap who had commanded an elephant in Bomber Command." From it he had learned an important law of nature, namely, that the more you put in the more you got out. He wondered what historians would say about what had been put into Bomber Command during the war and what had come out. Certainly no force in history had been better led. In the future the country would be even more anxious to see value for money. Remarking that "the night camera had cut down the number of heroes in Bomber Command," he said that the crews in the Command were better now than ever before. Referring to Sir Hugh P. Lloyd as a professor of economics, he said that as C-in-C. Bomber Command he had made sure that everybody should know that the better they were individually the fewer bodies of all kinds would be needed.

Air Chief Marshal Sir Hugh Lloyd, K.B.E., C.B., M.C., D.F.C., said that the P.F.F. dinner was one of the leading functions of the R.A.F. in London and great credit was due to the chairman and organization. Bomber Command was in the good, safe and capable hands of its new C-in-C., Air Marshal G. H. Mills, C.B., D.F.C. It was now the senior Command, so it would have to work all the harder to set the example worthy of its pride of place.

Bomber Harris was next called to his feet. In an amusing and forceful speech he said he was satisfied that Bomber Command's efforts during the war were not wasted; they could only be assessed by "the customers"—who were always right.

The toast of "The Guests" was proposed by Mr. L. G. Johnson, D.F.C., vice-president of the Pathfinder Association. Sir James Barnes, K.C.B., K.B.E., Permanent Under-Secretary of State to the Air Ministry, replied for the guests, and recalled some amusing contacts with Sir Arthur Harris during the war—in particular his remark on meeting a V.I.P.: "And what part of the war effort are you impeding today?"

Finally, as is the custom, everyone drank to "Absent Friends," proposed by Mr. Peter H. Swan, D.S.O., D.F.C.



OF THE HOUSE OF WINDSOR: Flying solo the only Harvard ever to wear five-star insignia, the Duke of Edinburgh passes over Windsor Castle in formation with his instructor, F/L. Gordon, from whose aircraft this photograph was taken.

Duke of Gloucester in Iraq

AFTER attending the recent accession ceremonies of King Feisal, the Duke of Gloucester paid visits to Habbaniya and Amman. The Duke, wearing the uniform of an air chief marshal, was travelling in a chartered B.O.A.C. Argonaut and he was accompanied by Air Chief Marshal Sir Arthur Sanders, A.O.C-in-C., M.E.A.F., and A.V-M. Hawtrey, A.O.C. Iraq. On arrival at Habbaniya he was greeted by the Station Commander, G/C. R. A. T. Stowell and a Guard of Honour of R.A.F. Iraq Levies.

His Royal Highness inspected No. 6 Squadron—the pilots of which put up a 20-minute display of formation flying and aerobatics on their Vampires—and studied photographs taken by No. 683 Squadron while air mapping Aden and British Somaliland.

On the following day, at Amman, the Duke, with the Station Commander, G/C. E. W. Palmer, watched a demonstration by the R.A.F. Regiment, and inspected the new runway project.

R.A.F.A. Legal Panel Dines

THE third annual dinner of the R.A.F.A. legal panel was held in London on Saturday last. In the chair was A.V-M. Sir Geoffrey Bromet and Lord Goddard was the guest of honour. A report of the function will appear next week.

Coronation Fly-Past

THE Royal Air Force salute to the Queen on Her Majesty's return to Buckingham Palace following the Coronation Procession on June 2nd will be given by a mass formation of 168 fighters, 144 R.A.F. Meteors and 24 R.C.A.F. Sabres.

Approaching the Palace from south of the Thames, the formation is due to pass over St. James's Park and fly across The Mall at 5.15 p.m., passing from the right to the left of Her Majesty, who will be on the balcony to take the salute.

The formation will fly at 345 m.p.h., the heights of individual wings being stepped down from 1,500ft to 1,100ft. The basic formation will be two broad arrowheads, linked by a central group of aircraft. It will be a compact mass, covering an area about 2,200 yards long and 640 yards wide, taking only 15 seconds to pass.

The leading arrowhead will comprise 72 Meteors, in three groups of 24. Each of these groups will be made up of six "boxes" of four aircraft. Immediately behind will be the 24 Sabres, also flying in six "boxes" of four. Then will come the second arrowhead of Meteors, flying an identical pattern to the leading formation.

Formation leader will be W/C. J. Wallace, D.S.O., D.F.C., officer commanding the flying wing at R.A.F. Station Duxford, Cambridge. The flanking formations in the leading arrowhead will be led by W/C. D. Crowley-Milling, D.S.O., D.F.C.

SERVICE AVIATION . . .

(R.A.F. Station Tangmere, Sussex) and W/C. D. C. Smallwood, D.S.O., M.B.E., D.F.C. (R.A.F. Station Biggin Hill, Kent). The R.C.A.F. Sabres will be led by W/C. J. D. Lindsey, D.F.C. (R.C.A.F. Station North Luffenham, Rutland).

Leading the three Meteor wings making up the second arrowhead will be W/Cs. L. H. Bartlett, D.S.O. (R.A.F. Station Wattisham, Suffolk), R. D. Yule, D.S.O., D.F.C. (R.A.F. Station Horsham St. Faith, Norfolk) and P. P. C. Barthropp, D.F.C. (R.A.F. Station Waterbeach, Cambridge).

The R.A.F. squadrons taking part will be Nos. 1, 41, 54, 56, 63, 64, 65, 74, 245, 247, 257 and 263 and the R.C.A.F.

CORONATION DAY
R.A.F. FLY-PAST

Duxford Wing

Tangmere Wing Biggin Hill Wing

R.C.A.F. Sabre Wing

Wattisham Wing

Waterbeach Wing Horsham Wing

Wing order for the salute formation over Buckingham Palace on June 2nd.

squadrons Nos. 410, 439 and 441. No. 74 Squadron is commanded by Major G. W. Milholland, who is with the R.A.F. from the U.S.A.F. on the officer exchange scheme.

A.V-M. the Earl of Bandon, C.B., D.S.O., A.O.C. No. 11 Group, will control the fly-past.

Component wings will join up over Canterbury and fly along the South Coast, over Dungeness and Hastings, to Bexhill, where they will turn north-west and set course for The Mall, gradually closing up into the salute formation.

The final run-in from R.A.F. Station Biggin Hill to The Mall will be over Keston, West Wickham, Beckenham, Sydenham, Dulwich, Herne Hill and Kennington. After the salute the formation will break away at a point about three miles north of St. James's Square, the wings then returning direct to their bases.

AT THE R.A.E.: G/C. A. E. Clouston speaking at the dining-in night at the Empire Test Pilots' School (see "E.T.P.S. Presentation" on this page). Others at the table are: S/L. Macfie, Mrs. Wroath, Mrs. Barrington-Kennett, S/L. Crozier, Air Chief Marshal Sir Robert M. Brooke-Popham and Mrs. Clouston.

E.P.T.S. Presentations

AT a recent dining-in night, Mrs. Barrington-Kennett presented the Empire Test Pilots' School with a silver slipper—a wedding present from Col. S. F. Cody, who built and flew the first Army aeroplane; a silver model of a Nieuport monoplane, which was given to her late husband by brother officers of the Royal Flying Corps; and Major Barrington-Kennett's log-book.

The function was attended by Air Chief Marshal Sir Robert M. Brooke-Popham, who was a squadron commander in the R.F.C. contemporary with Major B. H. Barrington-Kennett, and the gifts were accepted by G/C. A. E. Clouston, the retiring commandant of the school. G/C. S. Wroath, who took over E.T.P.S. last week, was also present.

Major B. H. Barrington-Kennett of the Grenadier Guards was seconded to the Air Battalion of the Royal Engineers, the forerunner of the Royal Flying Corps, which came into being in April, 1912. He went to France with the R.F.C. in 1914, but in 1915 he returned to the Grenadier Guards and was killed in action at Festubert.

CORONATION VISITORS: The Australian High Commissioner, Sir Thomas White, inspecting the Royal Australian Air Force Coronation contingent on the flight deck of H.M.A.S. "Sydney," in which they travelled to Britain.

R.A.A.F. Pilots Decorated

THE immediate award of the D.F.C. to F/L. C. J. Sugden, an Australian pilot flying Meteors with No. 77 Squadron in Korea, has been announced. No citation has yet been published. In connection with the same incident W/O. R. Turner is Mentioned in Despatches.

At a special investiture, held recently at the Governor's Palace, Valetta, Malta, two more Australian pilots of No. 77 Squadron, R.A.A.F., were decorated in recognition of their service while they were in Korea. They were: F/O. R. Hunt, who received the D.F.C., and P/O. J. Meyers, who was awarded the D.F.M.

R.N.V.R. Squadron Commanders

THE following officers have been appointed to command four of the recently formed squadrons of the Royal Naval Volunteer Reserve: Lt-Cdr. A. B. C. Ford, D.S.C., R.N.V.R. (No. 1835 Squadron, Culham, Berkshire); Lt-Cdr. M. Ross, R.N.V.R. (No. 1843 Squadron, Abbotsinch, Scotland); Act. Lt-Cdr. R. A. Jameson, R.N.V.R. (No. 1842 Squadron, Ford, Sussex); Act. Lt-Cdr. T. Adkin, R.N.V.R. (No. 1836 Squadron, Culham, Berkshire).

H.M.S. "Triumph"

IT has been decided that the aircraft carrier H.M.S. *Triumph* is to replace the cruiser H.M.S. *Devonshire* as the naval cadet training ship towards the end of this year. Accommodation modifications are required to fit the carrier for her new duties.

Combined London R.Aux.A.F. Ball

A NUMBER of tickets are still available for the all ranks Coronation Ball, which is being held at the Royal Festival Hall, London, on Friday, June 5th, from 11 p.m. to 5 a.m. The Air Minister, Lord De L'Isle and Dudley, V.C., and the Under-Secretary of State for Air, the Hon. G. Ward, have both accepted invitations to be present.

The ball is organized by the committee of the Combined London R.Aux.A.F. Units and tickets, 17s 6d, may be had from the secretary, 17/19, Queen Square, London, W.C.1.

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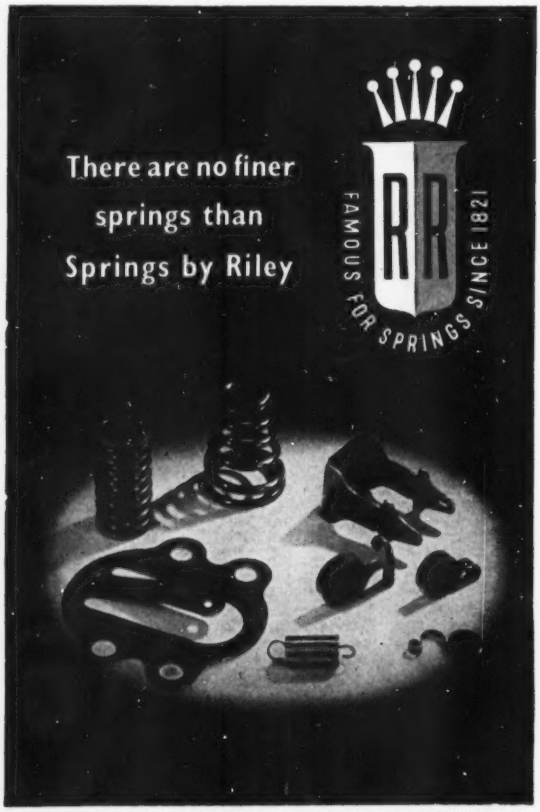

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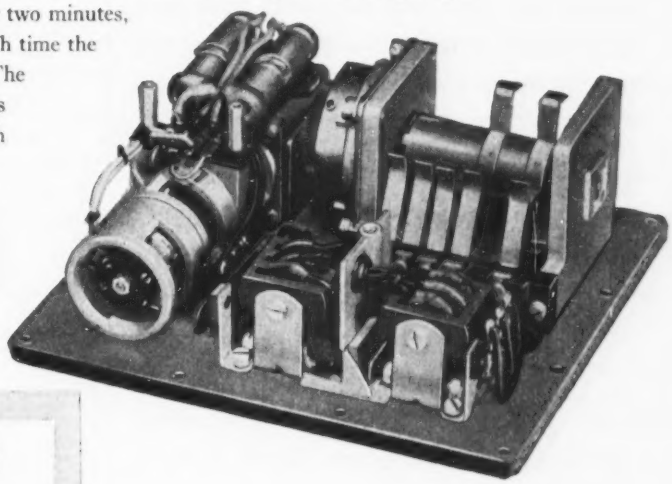

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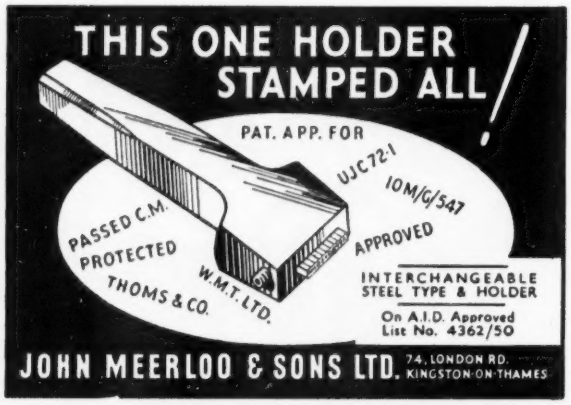

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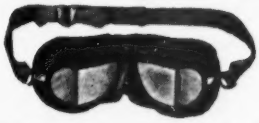

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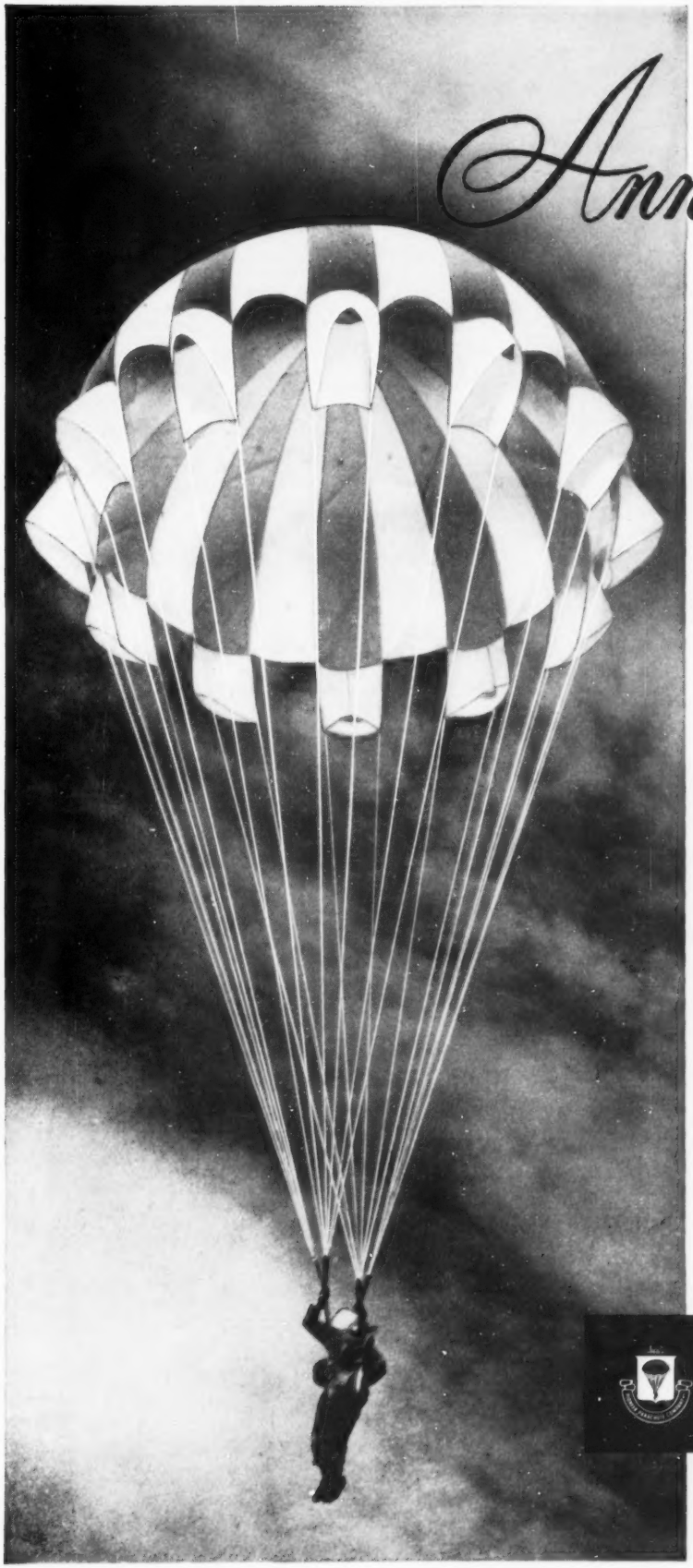

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